

AUTOMOTIVE INDUSTRIES

Founded 1895

Vol. 75, No. 25

December 19, 1936

This Week

Where and how many automotive parts can be sold is answered in an article and series of tables starting on page 848. Here the whole U. S. market is analyzed.

The Sterling Engine Co. has designed a new crankless engine. An illustrated description of it will be found by turning to page 856.

The new Oldsmobile "6" engine is shown in the drawings on pages 863 and 864.

The specifications of 1937 passenger cars, that are proving to be so serviceable, will be found on page 865.

Output Nears Half-Million

High Production Rate to Be Maintained During December Unless Strikes Halt Flow of Supplies

By Harold E. Gronseth

In the face of labor troubles that have been affecting suppliers, the automobile industry has been able to push its production rate up to a new high December level and so far this month has been operating at the rate of 500,000 units for the full month. Saturday operations are helping to make up for strike enforced setbacks in production. Several companies are heading toward new all-time output records. But by the middle of December the industry had turned out more vehicles than in all of October. Barring short-

age of materials, Ford, General Motors and Chrysler will account for more vehicles this month than were built by the entire industry in December last year when output totaled 418,317 cars and trucks.

Maintenance of this heavy production rate to the end of December hinges entirely upon the labor situation which so far has affected primarily the suppliers. In some way, the car manufacturers have managed to escape a shortage of glass despite the extended strike which for seven weeks has tied up one large producer and has now closed the plants of the other principal source. But curtailment of automobile production is expected to follow shortly unless an early settlement can be effected of the strike which has closed the Kelsey-Hayes wheel plants which, in addition to wheels, also supply brakes to some of the major car builders.

There is still a big shortage of cars in the field despite heavy shipments and the bank of unfilled orders has been whittled down only slightly. As fast as the cars have been built they have been going into the hands of consumers. But new orders have been taken almost as fast. In some instances, December deliveries have been 50 per

(Turn to page 845, please)

Strike Menace Grows

Only Four Weeks' Glass Supply on Hand as Plate Glass Strike Is Deadlocked; Sitdowns Close Other Detroit Plants

Only a four weeks' supply of safety glass was on hand for automobile production, it was estimated, as the strike of glass workers extended to plants in Toledo, Ohio, Charleston, W. Va., and Shreveport, La. Negotiations between company and union officials reached a deadlock this week as officials of automobile union workers announced their entire support of the glass strikers.

Workers in the foundry of the Aluminum Co. of America's Detroit plant joined this week with those of other departments who went on strike Dec. 10 with a demand for a 20-cent an hour wage increase. Approximately 1800 men are involved in the strike and many are joining the United Automobile Workers Union, which came to their assistance after the men had started their sitdown. The management has so far refused to meet a committee that includes union representatives, and the strikers have refused to meet with the management unless union representatives are present.

Headquarters of the UAW announced that a strike had been called Dec. 17 at the plant of National Automobile Fibers, Inc., in Detroit because of the alleged discharge of 10 em-

ployes who had been elected to a union committee to deal with the management. The company denied that it was involved in a strike but admitted that part of its working force failed to report for duty as a result of a picket line thrown around the plant, and made up of pickets involved in other strikes. The company employs about 1300 workers, more than half of whom are women, and manufactures floor mats, door panels, cushions, etc., for automobile firms. Demands involving wage increases, hours and reinstatement of discharged workers are being formulated by the union and would be presented to the management in the near future, it was said.

A strike at the plant of the Hercules Motors Corp., Canton, Ohio, was called by members of the UAW, it was stated at union headquarters. Officials claimed the management had refused to sign an agreement granting union recognition and seniority rights, but said that negotiations were under way.

The Kelsey-Hayes Wheel Co.'s plant in Detroit was closed Dec. 16 by a sit-down strike but reopened the following day with a partial force working.

(Turn to page 844, please)

New AMA Price Policy

Members to Make Factory F.O.B. Prices All-Inclusive

On the eve of the directors' meeting of the Automobile Manufacturers Association scheduled for Dec. 18, Alvan Macauley, president, announced a change in the policy of its members with respect to the prices at which their products are quoted in national advertising.

The new move is made to clarify and simplify the price situation. No price increase is involved.

Mr. Macauley's statement is as follows:

(Turn to page 844, please)

Plan to Control Trade Drafted

Council for Industrial Progress Appoints Committees to Prepare Legislation; Many Industries Absent

President Roosevelt soon will have laid before him legislation proposed by Maj. George L. Berry's Council for Industrial Progress as the result of the meeting of the council in Washington last week. Many industries, including the automotive, steel, rubber, textile, metal-working and other large groups did not participate in the meeting.

The highlights of the Berry meeting were proposals for a fair trade act, in some respects similar to the NRA; amendments to the anti-trust laws; and Government loans to small enterprises. Boards, courts, committees, etc., would also be set up if recommendations of the council committees are enacted into law.

The recommendations made are not only numerous but some are apparently contradictory and a committee from the council will attempt to coordinate the program. The chief task will be to frame a fair trade act. The recommendations of the council propose definitions of unfair competition, standards for wages and hours, trade practices and other features of the old NRA. Exemption from the anti-trust law would be granted under certain circumstances. Berry said it is hoped to frame the legislation within constitutional limits.

Briefly, recommendations of the committees of the council follow:

Committee on National Industrial Policy: New NRA to control production "under emergency conditions"; to fix minimum wages and maximum

hours; to set up fair trade practices; establish a permanent advisory council to study national income, its sources, distribution and uses.

Committee of Fair Trade Practices: Enactment by Congress of model fair competition act. Administrative body to be constituted out of Federal Trade Commission "or otherwise."

Committee on Anti-Trust Laws: Amendments to provide equal opportunity for all competitive enterprises. Optional filing of voluntary trade agreements with designated tribunal to be established. Creation of appellate court to hear appeals from administrative agencies which now go to United States Circuit Court of Appeals.

Committee on Financial Aid to Small Enterprises: Reaffirms previous recommendations for direct Government loans to small enterprise by RFC or new agencies to be set up by legislation.

Committee on Employment and Unemployment: Legislation to hold national census of employment status every five years.

Committee on Internal and External Competition Affecting American Standards: Setting up by Government of National Economic Research Council to analyze data regarding extent, use and perpetuation of nation's resources; sources, use and means of safeguarding nation's income; interrelated functions of labor, private capital and Government agencies.

Committee on Government Competition With Private Enterprise: Reaffirms former report on evils of Government competition.

Committee on Taxation: Urges council for industrial progress to undertake through this committee a study to determine the deterrent effect of present taxes upon enterprise and employment with view to recommending such changes as will produce maximum tax revenue with minimum burden on industry and public; would place greatest tax on "least useful" income and tax income rather than sources of income.

R'y Interest in Buses, Trucks Shown

ICC Report Gives Details of Steam Roads' Investments and Returns from Motor Vehicle Operations

The investments of steam railways in highway motor vehicle enterprises are shown in a report issued by the Interstate Commerce Commission, Bureau of Statistics. The compilation shows investments as of May 1, 1936, and is based upon returns made by Class I steam railways (excluding switching

and terminal companies) in response to a circular issued April 27, 1936.

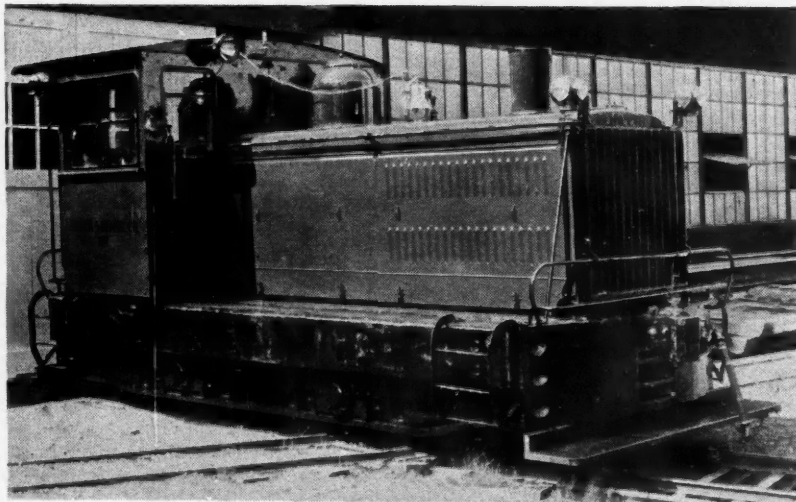
The abstract of the returns is arranged in three tables which give respectively, (I) a list of the enterprises in which railways had a financial interest, directly or indirectly, as of May 1, 1936; (II) a statement of the financial transactions between the reporting railways and these highway enterprises for the year 1935; and (III) selected financial and operating data of the highway carriers involved.

The grouping by districts is in accordance with the arrangement of railway companies in the "Statistics of Railways" and not according to the territory covered by the highway carriers.

In each table, highway carriers are grouped under the headings "Bus," "Truck" and "Unclassified," the last including station companies, lessor companies and others for which sufficient information to permit of classification was not available. Companies operating both buses and trucks were classified according to the major source of their revenues.

Class I railways, had on May 1, 1936, a financial interest in 128 highway motor vehicle enterprises, according to the report. In the majority of cases, the interest was indirect, through an intermediate company.

The aggregate capitalization (par value) held by railways, or some intermediary, in these highway carriers was \$43,109,361 as shown in the accompanying table. (See top of next page.)



Gasoline Locomotive Shunts Cars for Buick

Railway cars are switched at the Buick Motor Co.'s plant in Flint by the Plymouth 30-ton, 180 hp. 4-wheel standard gage gasoline locomotive, said to be the first application of this nature in an automotive factory. The locomotive was built by the Plymouth Locomotive Works, Fate-Root-Heath Co., Plymouth, Ohio, and complies throughout with the specifications of the Interstate Commerce Commission.

Railway Investments in Highway Transport Companies

| Class of Company | Stocks | Bonds | Advances | Total |
|-----------------------|---------------------|--------------------|---------------------|---------------------|
| Bus Companies | \$20,126,888 | \$7,161,067 | \$9,103,845 | \$36,391,800 |
| Truck Companies | 4,149,601 | 190,450 | 1,259,840 | 5,599,891 |
| Unclassified | 837,006 | 126,500 | 154,164 | 1,117,670 |
| Total | \$25,113,495 | \$7,478,017 | \$10,517,849 | \$43,109,361 |

The above totals overstate the extent of the financial interest of steam railways because they represent, not the investment by the rail carrier, but the capitalization of actual highway carriers regardless of the extent to which they are controlled by a railway or some intermediary.

Steam railways received, according to Table II, during the calendar year 1935, \$3,530,899 as dividends or interest, \$328,704 as repayment of advances, and \$1,124,175 as rents or other payments, a total of \$4,983,778. The dividends of \$3,530,899 amounted to 55.3 per cent of the total dividends declared by the highway companies.

Table III gives for the calendar year 1935 a selection of items from the income accounts and balance sheets of 128 highway motor carrier enterprises in which railways had a financial interest. The total assets amounted to \$89,508,108 of which \$59,231,728 was in plant and equipment. There was accrued depreciation of \$23,762,239. The corporate deficit at the close of 1935 was \$9,136,442, but if the deficit of the Berkshire Street Railway Co. be excluded, there was a surplus of \$5,074,060. Of the total assets, bus companies held 82.40 per cent, truck companies 15.70 per cent and other companies 1.90 per cent.

The Railway Express Co. Agency, Inc., and Southeastern Express Co., which are important highway carriers, are not covered by this tabulation.

Big Increase in Accessory Sales Reported by Graham

In October and November alone, Graham accessory sales ran 56 per cent ahead of the total volume for all of 1935, reports C. W. Matheson, vice-president of the Graham-Paige Motors Corp. Heater sales for the past two months have run 64 per cent more than last year's entire volume, Mr. Matheson says. The new Graham heater may be fitted to either the 1937 or any earlier Graham models. Running nearly double the 1935 volume are Graham radio sales. Other accessories which have shown a marked advance during the past two months are the overdrive, sales of which have doubled last year's figure; and the ventilating wings which are selling at nearly three times the rate they did in 1935.

Six Diesel-Electric Trains Ordered by Rock Island R.R.

Six Diesel-electric streamlined trains, costing more than \$2,000,000, have been ordered by the Chicago, Rock Island & Pacific Railroad, according to an announcement by E. M. Durham, Jr.,

chief executive of the road. It is said to be the largest single order ever placed by an American railroad for streamlined Diesel equipment.

The order for 20 passenger cars and six power cars has been placed with the Edward G. Budd Manufacturing Co. of Philadelphia. Electro-Motive Corp. of La Grange, Ill., General Motor subsidiary, will build the six 1200 hp. Diesel engines.

Nash Service Men Meet

Nash Motors Co. was host to more than 150 service and parts managers at its factory at Kenosha, Wis., this week. L. L. Virgin, service manager, was in charge of the week's activities. Starting on Tuesday and continuing through the remainder of the week, schools were conducted at which every detail of the new cars was discussed.



Adolf Gelpke

Who has been promoted to chief engineer of the Autocar Co.

New England Truck Census Figures

Gross Business Amounted to \$44,717,000 in 1935;
3904 Concerns Employed 13,818

The sum of \$44,717,000 was received in 1935 by 3904 concerns with headquarters in the New England States whose primary business was motor trucking for hire, it was announced this week by William L. Austin, director, Bureau of the Census.

The 3904 concerns reported an average of 13,818 persons on their pay rolls for the year. A total of \$17,134,000 was paid to these employees in 1935, of which \$15,684,000 was paid to full-time and \$1,450,000 to part-time employees. This did not include compensation to the 3704 active proprietors and firm members of unincorporated businesses.

The number of vehicles in operation by these concerns in October, 1935, amounted to 12,578. While the number of vehicles in operation would fluctuate from month to month, October was chosen as representative for the year. Stand-by equipment was not included. In counting the number, semi-trailers and tractors were considered as separate vehicles.

Massachusetts led all the New England States in the number of truck-

ing concerns and the amount of revenue. The 1738 concerns located in Massachusetts (44.5 per cent of New England total) received \$25,762,000 or 57.6 per cent of total New England trucking revenue. These same concerns paid out \$10,384,000 to their employees or 60.6 per cent of the total New England payroll.

Analysis of the data for local, intrastate, and interstate truckers shows that those primarily engaged in interstate hauling accounted for almost exactly one-half (50.1 per cent) of total receipts, although they represented only 10.7 per cent of the total number of concerns. Revenue from all sources for interstate truckers was \$5,141 per vehicle operated, as compared with \$3,589 for intrastate and \$2,357 for local operators.

Persons employed by interstate operators represented slightly less than one-half (46.6 per cent) of total employees, but received 52.1 per cent of the total payroll.

A summary of data by kind of trucking as compiled by the Bureau of the Census follows:

Kind of Trucking

| | Total | Local | Intrastate | Interstate |
|--------------------------------------------------|--------------|--------------|-------------|--------------|
| Number of Concerns | 3,904 | 2,960 | 525 | 419 |
| Gross Revenue | \$44,717,000 | \$13,757,000 | \$8,559,000 | \$22,401,000 |
| Number of Vehicles | 12,578 | 5,836 | 2,385 | 4,357 |
| Proprietors | 3,704 | 2,868 | 488 | 348 |
| Employees | 13,818 | 4,643 | 2,739 | 6,436 |
| Pay Roll—Total | \$17,134,000 | \$4,769,000 | \$3,435,000 | \$8,930,000 |
| Full-time | 15,684,000 | 3,945,000 | 3,223,000 | 8,516,000 |
| Part-time | 1,450,000 | 824,000 | 212,000 | 414,000 |
| Other Expense (Not Including Depreciation) | 19,334,000 | 5,159,000 | 3,536,000 | 10,639,000 |

Chevrolet Opens New Body Plant

Ceremonies Inaugurate Indianapolis Factory with Daily Capacity of 2000 Commercial Car Bodies

What is believed to be the world's largest plant devoted exclusively to the manufacture of commercial bodies was formally opened at Indianapolis Dec. 18 with ceremonies sponsored jointly by Indianapolis civic authorities and officials of General Motors and Chevrolet.

Civic, business, and industrial leaders of the city joined in the ceremonies which officially opened the new plant. Officials of General Motors and Chevrolet, led by W. S. Knudsen, General Motors' executive vice-president, and M. E. Coyle, general manager of the Chevrolet Division, General Motors Corp., were the guests of honor at the annual banquet of the Chamber of Commerce held in the Hotel Claypool, in recognition of Chevrolet's new contribution to the industrial progress of the city.

During the day, visitors to the plant were entertained by a 36-piece employees' band under the leadership of Wayne Steel, one of the tool crib attendants in the factory.

Work on the new factory was started a year ago and was completed without the loss of a single day's production in one of the most unusual industrial construction operations on record. The new building literally swallowed the old as construction proceeded, unit by unit. As each new portion of the new factory was completed, a department was moved into it from the old structure. The part of the original plant assigned to that particular operation was then torn down to make way for another section of the new plant.

As the old buildings, of which there were a half dozen, were vacated, department by department, conveyor lines were kept running under temporary cover until they could be located in their new home. Portable tin roofs were moved around as needed to protect the conveyors.

Chevrolet's new industrial unit, considered to be one of the largest and most modern commercial body plants in the world, will be capable of producing approximately 2000 bodies a day, officials estimated. It will manufacture, in all, 15 different body types supplying the full requirements of the company for commercial bodies for both domestic and foreign distribution. The plant contains nearly three miles of conveyors.

Adequate air circulation and ventilation is provided in the most up-to-date heating and cooling system engineers have yet devised. Fans have been placed in the trusses of the system at intervals of approximately 80 ft. throughout the plant. Warm air, generated in the plant's own power house, is diffused throughout the factory in winter, and cool air is circulated in summer. The power house which supplies the heat and industrial steam, is equipped with two 500-hp. boilers.

The new Chevrolet plant includes three of the largest presses in the world, and two 25-ton cranes for moving heavy metal within the plant and loading it on freight cars. There are also more than 100 other presses of various kinds and sizes, and several dozen welding machines along with other manufacturing equipment.

An interesting problem presented itself to officials in connection with the installation of the three huge presses, which are 38 ft. high and weigh more than 340 tons each. The top section of each weighs 45 tons by itself. Some official concern was expressed as to how the 45-ton section was to be raised 38 ft. by means of a crane capable of lifting only 25 tons. After considerable weighing of the problem, it was decided the raising could be accomplished only by jacking up the heavy unit several inches at a time. With each jacking effort, huge timbers were slipped under-

neath the weighty section. After three days' work, it was rolled off its bracing and into place in the assembled press. The process was repeated in each instance.

The new factory contains 472,522 sq. ft., has 132,177 ft. of loading space, and includes twice as much glass in it as it has brick. It is built in the shape of an "L," with an overall length of 1121 ft. 10 in., and an overall width of 602 ft. 4 in. To make the "L" the wing runs 401 ft. 10 in. long, then jogs over 280 ft. 6 in., and runs another 702 ft. long. The last dimension is a width of 321 ft. 10 in.

The dedication ceremonies come at the close of Chevrolet's first six years in Indianapolis. The company purchased its plant then from the Martin-Parry Corp. in the fall of 1930. The plant had been a carriage factory originally.

The company will give employment to approximately 1400 Indianapolis workmen in the new plant, and the commercial car and truck bodies they turn out will mean the purchase by Chevrolet of some 45,000 tons of steel this year.



ADOLF GELPKE has been promoted chief engineer of the Autocar Co., Ardmore, Pa. Mr. Gelpke began work with Autocar as blue-print boy in 1910. From 1912 to 1915 he was on the faculties of the University of Pennsylvania and the Germantown Y. M. C. A. In 1915 he returned to Autocar and since 1927 has been assistant engineer.

R. A. LEAVELL, who has been engaged in automobile publicity work for many years, more recently with Dodge and Reo, has been engaged by the Midget Automobile Association as chief timer for the Saturday night races at the State Fair Coliseum in Detroit. Mr. Leavell is well known for his work with electric timing devices which he has used for road, water and air races.

W. WAITS SMITH has been appointed executive engineer of the Studebaker Corp. It is announced by Roy E. Cole, vice-president in charge of engineering.

GEORGE J. STRITCH, who has been associated with the B. F. Goodrich Co. for the past 16 years, has been named manager of the manufacturers' sales division office of the company in Detroit.

EDWARD F. COOGAN, who has been assistant sales manager in charge of new branch operations with the Autocar Co., Ardmore, Pa., has been promoted sales manager of his company. Mr. Coogan has been associated with the automotive industry since 1905 when his first job was with the Springfield factory in Springfield, Mass.

CHARLES S. THOMSON, export manager of the Four Wheel Drive Auto Co., has left for Argentina where he will make a business tour of three months.



Modern lines characterize the new GMC half-ton trucks.

Racing Rules Changed

New Formula Attempts Placing
Supercharged Engines on
Par with Others

Entirely new racing cars will have to be built to fit the international formula adopted by the International Sporting Commission for the years 1938, 1939 and 1940. The only restriction at present is a maximum weight of 1650 lb., and under this rule supercharged engines of rather more than 366 cu. in. have been built.

The new rule attempts to place non-supercharged and supercharged engines on an equal basis. For the unblown jobs the minimum piston displacement is 1000 cc. (61 cu. in.) with a minimum weight of 881 lb.; the maximum piston displacement is 4500 cc. (274.6 cu. in.) with a minimum weight of 1873 lb. When a blower is used the minimum piston displacement is 666 cc. (40 cu. in.) and the maximum 3000 cc. (183 cu. in.). The minimum weights remain the same. The minimum weight includes the tires used for the race, but not the oil, water, fuel, tools or spare wheels. There is no restriction on the quantity or quality of fuel, and all body restrictions are removed, with the exception of a minimum width of 33½ in.

The coefficient of 1.5 has been subjected to much criticism as favoring the supercharged engine. It is argued, however, that the last 10 years of racing have developed supercharged jobs and that non-supercharged engines can be improved to a position which will make the coefficient equitable.

Designers can play with both weight and piston displacement. For given piston displacements the respective weights would be:

| | Super-charged | Non-super-charged |
|---------------|---------------|-------------------|
| 1000 cc. | 1020 lb. | 880 lb. |
| 1500 cc. | 1232 " | 1020 " |
| 2000 cc. | 1445 " | 1161 " |
| 2500 cc. | 1656 " | 1302 " |
| 3000 cc. | 1870 " | 1445 " |
| 4000 cc. | | 1727 " |
| 4500 cc. | | 1873 " |

Transport Economics Course Given by Chicago University

The importance of transportation is recognized by the offering of a practical college course in transportation economics by the University College, Chicago, by Lewis C. Sorrell, professor of transportation of the University of Chicago school of business. The course presents a comparative study of services, costs and rates of service of railway, waterway, highway and airway carriers.

Ford Assembly Plant For Vancouver, B.C.

Plans for additional expansion of Ford Motor Co.'s plant in Canada involving construction of a new branch assembly plant at Vancouver, B. C., to

serve the British Columbia territory, and erection of a branch warehouse at Regina, Sask., were announced by Wallace R. Campbell, president.

The new Vancouver plant will cost approximately \$400,000 and will have a capacity of 30 cars daily. The new warehouse at Regina will adjoin the present sales and service building. It will cost approximately \$50,000.

These two new Ford branch projects will bring the total of Ford expenditures thus far allocated for Ford home office and branch expansion to nearly \$5,500,000, Mr. Campbell pointed out.

:SLANTS:

"OUT OF THE HAT"—An English bus operating company recently opened bids for six new Diesel-engined buses. Two leading manufacturers had submitted offers. Prices and specifications were so close that after endless discussion bus company officials were as far as ever from a decision between the two bids. So representatives of the two manufacturers were invited to a luncheon where the order was to be settled by lot. Twelve slips were put in a hat—actually, a silver bowl—six marked with the initial of one manufacturer and six with that of the other. Drawn out one by one, the laws of chance operated so that it was only on the 11th draw that all six slips of one manufacturer came out. To him went the contract, worth £12,000.

HOTELS vs. TRAILERS—Like Canadian hoteliers, U. S. "greeters" are also worried by trailer coach competition. The subject was thoroughly threshed out at the recent convention of the Indiana Hotel Association where Walter L. Gregory, of the Palmer House, Chicago, said: "We must face the competition of the trailer. With the end of the depression we will also find the end of the tourist camp, but now we must offer the tourist advantages that will outweigh parking under a tree for the night."

MASS FLIGHT—Some sort of a new "first" took place last week when the entire sales force of Stewart-Warner's Alemite division, numbering 80, took off from their various cities to assemble in Chicago for a convention. Charles Fine, Alemite sales manager, said the use of 200 m.p.h. airliners saved a lot of time for his salesmen.

AMBER LIGHTS—Headlight glare will be eliminated, it is hoped, by the amber lights which will be compulsory in France on new cars sold after April, 1937, and on all cars after January, 1939. Cadmium bulbs will be generally used, it is said, although there is nothing in the decree to prevent the use of filtering glass for the headlights, provided they are approved as efficient.

WAGE PEAK—"Workers in the automobile industry will average \$340 more in their pay envelopes than the

workers of any other industry. . . . The income per worker will be higher than during any previous year in history," said W. S. Knudsen, GM executive vice-president, at a dinner meeting last week in the Oldsmobile engineering building sponsored by the Industrial Executives Club.

CARRIAGES—Henry Ford's replica of an old American village at Dearborn, Mich., will soon be enriched by a rare collection of horsedrawn vehicles and early automobiles. The huge collection of the late Theodore C. Wohlbruck, Redwood City, Calif., photographer, fruit of a life-long hobby, has been purchased by Mr. Ford for his museum village. There are tallyhos, stage coaches, hacks, saddles and trappings as well as carriages in the collection.

Million Chryslers

Corporation's Output Passes Mark
for First Time in One Year

For the first time in its history, Chrysler Corp. has produced one million passenger cars and trucks within one year. The millionth car this year came off the assembly lines Dec. 15 at the Plymouth plant in the presence of Walter P. Chrysler, chairman of the board; K. T. Keller, president; B. E. Hutchinson, chairman of the finance committee; F. M. Zeder, vice-chairman of the board; J. E. Fields, president, Chrysler Sales Corp.; B. C. Foy, president, DeSoto Motor Corp.; D. S. Edkins, president Plymouth Motor Corp.; and A. vanDerZee, general sales manager, Dodge Brothers Corp. Fourth quarter output alone will be 270,000 cars, a gain of 11 per cent over 1935.

The largest previous annual production was 843,599 units for the year 1935. This year's million to date, with all plants in full operation, is more than twice the company's total annual production of 1929.

GM November Overseas Sales 5.9% Higher Than Last Year

Sales of General Motors cars and trucks to dealers in the overseas markets during November totaled 24,088 units, representing an increase of 5.9 per cent over the volume in November of last year.

In the first 11 months of 1936, sales totaled 294,713 units—an increase of 14.1 per cent over the volume of 258,283 in the first 11 months of 1935. For the 12 months ended Nov. 30, 1936, sales totaled 320,711 units, representing an increase of 16.7 per cent over sales in the 12 months ended Nov. 30, 1935.

Tuthill Spring Declares Extra

Directors of the Tuthill Spring Co., Chicago, have declared the regular dividend of 12 per cent and an extra dividend of 12 per cent on the capital stock of the company, payable Dec. 15, 1936.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

General business continued very active last week, and most lines anticipate further gains before the new year. According to the National Retail Dry Goods Association, Christmas trade throughout the country during the first 10 shopping days of this month shows an average gain of about 10 per cent above the level in the corresponding period last year. Department store sales in November, according to the Board of Governors of the Federal Reserve System, were the highest for any November in the last five years; this marks the third consecutive month in which department store business exceeded that of the corresponding month in 1931.

Sharp Gain in Carloadings

Railway freight loadings during the week ended Dec. 5 totaled 744,957 cars, which marks an increase of 64,973 cars above those in the preceding week, a gain of 106,439 cars above those a year ago, and a rise of 193,472 cars above those two years ago.

Power Output Higher

Production of electricity by the electric light and power industry in the United States during the week ended Dec. 5 was greater than that in the preceding week and was 13.9 per cent above that in the corresponding period last year.

New High for Chain Store Sales

The composite index of store chain sales compiled by the *Chain Store Age* for November stands at the preliminary figure of 110.8, a new high record, as compared with 109.5 for the preceding month.

Profits Up 66% in Year

According to the Federal Reserve Bank of New York, business profits of 229 industrial and mercantile concerns during the third quarter of this year were 66 per cent above those in the corresponding period last year, 19 per cent above those in the 1930 quarter, but were 41 per cent below those in the third quarter of 1929.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended Dec. 12 stood at 86.6, as against 86.7 the week before and 86.0 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended Dec. 9 showed no changes in holdings of discounted bills, bills bought in the open market, and government securities. Money in circulation increased \$31,000,000 and the monetary gold stock rose \$18,000,000.

\$12,164,768 in the corresponding period of 1935, an increase of approximately 50 per cent. The 1936 10-month total, it is pointed out, is four per cent greater than that recorded for the full year 1934 and 28 per cent in excess of the 1935 total.

Exports of aircraft were valued at \$8,786,326 in the January-October period of 1936 against \$5,944,312; parts and accessories, \$5,089,513 against \$4,220,772 and parachutes, \$266,794 against \$111,066, it was stated.

Approximately 85 countries purchased aeronautical products from the United States in the period under review, statistics show. China was the largest individual market, accounting for \$6,785,384 while Argentina ranked second with purchases totaling \$1,535,755.

Alemite Half Hour Radio Contract Renewed for '37

Through a contract renewal effective Dec. 28, 1936, the "Alemite Half Hour" with Horace Heidt's Brigadiers will continue to be broadcast over the nationwide Columbia network for a third year. Under the sponsorship of the Stewart-Warner Corp., the "Alemite Half Hour" is heard each Monday from 8:00 to 8:30 p.m.,

40 Years Ago

—with the ancestors of
AUTOMOTIVE INDUSTRIES

The "Noise" Question

Advocates of a perfectly noiseless motor carriage should look about them and study other types of road and track vehicles.

Noise is inseparable from locomotion and the higher the speed, as a rule, the greater the noise. The trolley is second only to the locomotive in the noise it makes in motion. The trolley virtually has two danger signals, the gong and the whirr of the motor. . . . The necessity of similar warning disappears in the horse vehicle for the reason the horse announces his coming with his hoofs . . . but carriages propelled by power within, especially when equipped with rubber tires, are required to use signals to warn pedestrians of their approach. What the authorities complain of, evidently, is that the new vehicle is too noiseless. . . .

What signal shall be chosen. The tinkle of the bicycle bell is peculiar to that vehicle and is familiar to all. The whistle is too suggestive of the locomotive and of steam in general. . . . The only alternative, then, seems to be the horn, one form of which is now in use among French manufacturers. The sound emitted by the Paris horn is not a musical one, but a danger signal should startle rather than please. —From *The Horseless Age*, December, 1896.

Cutting Fluids Studied

Independent Research Group to Collect Information, Publish Findings

Following some months of preparatory work, announcement is made of the formation of an Independent Research Committee on Cutting Fluids whose object is to correlate the existing knowledge of the utilization of cutting fluids and develop further studies leading to a better knowledge of cutting fluids and their utilization in automotive metal-cutting plants.

The announcement is made for the committee by its chairman, Joseph Geschelin, Detroit technical editor, AUTOMOTIVE INDUSTRIES. The personnel of the committee is as follows:

H. L. Moir, mechanical research dept., Pure Oil Co., Chicago; C. B. Harding, cutting oil engineer, Sun Oil Co., Detroit; George F. Bowers, technical division—lubrication dept., Standard Oil Co. of Ind., Chicago; Floyd Fritts, Standard Oil Co., Detroit; H. E. Martin, E. F. Houghton & Co., Detroit; Maurice Reswick, Standard Oil Co. of N. J., New York; C. L. Foreman, assistant metallurgical engineer, Buick Motor Co., Flint; A. C. Starling, chemist,

Budd Wheel Co., Detroit; Prof. O. W. Boston, dept. of metal processing, University of Michigan, Ann Arbor; W. D. Huffman, chief chemist, Chevrolet forge, Detroit; J. M. Jackson, chief chemist, Hudson Motor Car Co., Detroit; L. A. Herrmann, Standard Oil Co. of N. Y., Hartford; W. H. Oldacre, director of research and engineering, D. A. Stuart & Co., Chicago; Raymond Haskell, Texas Co., New York; M. W. Reynolds, Acheson-Colloids Corp., Port Huron, Mich.; E. M. Slaughter, Republic Steel Corp., Detroit, and Joseph Geschelin, Chilton Co., chairman of committee.

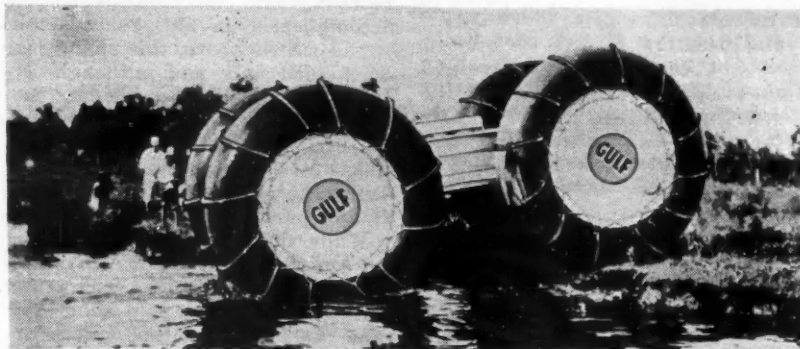
Two definite studies are now under way and will be released later for publication through engineering society meetings.

U. S. Air Exports Break All Records

Exports of aeronautical products from the United States during the current year have been at record levels, figures compiled in the Commerce Department's Automotive-Aeronautics Trade Division show.

Shipments abroad under this classification in the first 10 months were valued at \$18,271,077 compared with

The "Marsh Buggy" Travels On Land and Water



Strangest vehicle circulating in the U. S. is probably the "Marsh Buggy" used by the Gulf Oil Corp. to transport crews and equipment into the swamps of Louisiana. This ingenious automobile-tractor-boat hybrid is equally at home on land, in waist-deep mud or in water deep enough to float a liner. It weighs 7500 lb., has an overall length of 22½ ft. and is powered by a Ford V-8 engine with an oversize cooling system. At the rear, a passenger car transmission is coupled in series with a McCormick-Deering tractor gear box, the combination giving 10 forward and 6 reverse speeds.

The front wheels receive their power from chains passing over sprockets on the back axles. This gives a differential action between the wheels on either side but not between front and rear wheels. The transmission has two brakes, each controlling the wheels on either side, so that the machine can be steered when afloat by braking the wheels on one side.

The tires of the marsh buggy were

designed and fabricated by the Goodyear Tire and Rubber Co. and are said to be the largest ever molded. They are 10 ft. high, approximately 3 ft. wide and are mounted on 66-in. rims. Their displacement is so great that the vehicle floats with an immersion of less than 2 ft. In case of puncture of one tire a constant pressure can be maintained by a compressor which feeds air into the tube. In water or marshes traction is obtained by attaching to each wheel 12 treads made from 2 in. inflated rubber hose.

Aluminum was used to a great extent in the marsh buggy in order to assure lightness. The wheels, sides of the chassis, and platform are of this metal.

Besides an automobile license, the vehicle also carries a marine license and has fulfilled the requirements for Class 1 power boats.

Speed of the marsh buggy is 35 m.p.h. over smooth ground from 10 to 12 m.p.h. in swamps and in water it makes a little more than 6 knots.

nickel-chromium cylinder block. The bore is 2 3/16 and the stroke 2 15/16 in. and the engine has a displacement of 45 cu. in. The compression ratio is 5.5 and the engine is claimed to develop 12 hp. at 3000 r.p.m., its maximum speed being 4000 r.p.m. Engine weight is 155 lb.

The car has overall dimensions of 47¼ in. in width and 110¼ in. in length. The chassis weight is 845 lb. and the weight of the complete car (sedan), 1465 lb. A maximum speed of 44 m.p.h. is claimed and a fuel mileage of 37.5 per U. S. gal. The price of the phaeton is 2350 yen (\$670) and that of the sedan 2450 yen (\$700).

FTC Drops Complaints Against Tennessee Jobber Associations

Dismissal of its complaints against the Chattanooga Automotive Jobbers' Association, Chattanooga, Tenn., and the Tennessee Automotive Jobbers' Association, Knoxville, Tenn., was announced Dec. 14 by the Federal Trade Commission. The associations, officers and members had been charged with

entering into understandings and conspiracies to fix and maintain uniform prices for automobile parts and accessories and with boycotting customers and manufacturers and other practices.

The commission said its action was ordered following dissolution of the two associations. In the case against officers, directors and members of the Tennessee Automotive Jobbers' Association, the order said they had not engaged in the practices charged in the complaint.

The complaint was dismissed as to both associations and as to members of the Tennessee association, but, as to individual and company members of the Chattanooga association, the case was closed without prejudice to the right of the FTC, "should the facts so warrant," to reopen and resume prosecution of the complaint.

New Goodyear Plant

Hayes Factory at Jackson Being Equipped for Tire Making

The Goodyear Tire & Rubber Co. has purchased the plant of the Hayes Wheel Co., at Jackson, Mich., and has announced plans to equip immediately the factory for tire manufacture. The Michigan plant will be used principally for the manufacture of original equipment tires for car manufacturers and will eventually have a capacity of 10,000 tires daily. It will be equipped with the latest tire building machinery, including a large battery of individual watch-case vulcanizers.

Purchase of the Michigan plant is part of the Goodyear decentralization plan resulting from the company's protracted labor trouble. To date Goodyear has had 53 sitdown strikes, lasting from a few hours to six weeks. The entire Goodyear decentralization program embraces expansion of its Gadsden, Ala., and California plants to a daily capacity of 10,000 tires each; utilization of much of the production facilities of the Kelly-Springfield plant at Cumberland, Md., which it now controls; purchase of the eight-story Hupp engineering building in Detroit for warehouse purposes and finally acquisition of the Hayes plant at Jackson, Mich. In addition, Goodyear has a large Canadian tire plant.

Decentralization programs of other Akron tire companies include purchase of a subsidiary plant at Wabash, Ind., by General Tire & Rubber Co.; increase of capacity by Goodrich at its Los Angeles plant and renovation of an old reclaim plant at Oaks, Pa., and its conversion for tire making; and purchase by Firestone of the former Murray Wood Products plant at Memphis, Tenn. In addition, Firestone is said to be linked with Ford in the Ford company's plans, now under way, for a Detroit tire factory which will be in operation May 1 with an initial capacity of 5000 tires per day.

New Jap Light Car

Tsukuba Has Front Drive and Narrow V-Type 4-Cylinder Engine

The Tokyo Automobile Engineering Co., a subsidiary of the Rolling-Stock Manufacturing Co. and of the Automobile Industrial Co., has announced a new type of "baby" car which it plans to produce in large numbers. This makes the fourth make of baby car to be placed in production in Japan, the others being the Datsun, Ota and Kyosan. The newcomer, known as the Tsukuba, differs from the others in being of the front-drive type, the drive being somewhat similar to that used in the German Wanderer. It is claimed by the manufacturer that front drive goes far toward eliminating the instability common in small cars and that it gives a better weight distribution between front and rear wheels.

The four-cylinder engine is of the narrow V type, the two banks of cylinders making an angle of 25 deg. with each other. Cylinder heads of aluminum alloy are detachable from the

Strike Menace Grows

(Continued from page 837)

Its Windsor, Ont., plant was also affected by the strike. Edward C. McDonald and J. E. O'Connor, Federal Labor Department conciliators, have been assigned to the Kelsey-Hayes and Aluminum Co. strikes after an appeal for Government intervention had been made by R. T. Frankenstein, organizational director for the UAW.

A sitdown strike of 5850 employes in plants of the Libbey-Owens-Ford Glass Co. at Toledo, Charleston, W. Va., and Shreveport, La., began at midnight Dec. 14 on the call of Glen W. McCabe, president of the Federation of Flat Glass Workers.

The strike was called when the union committee rejected a counter proposal of the company calling for a wage increase of 5 per cent, or about \$500,000, to be apportioned equitably as suggested by the union, guaranteeing seniority, a plan for hearing grievances, and arbitration of any disputed points in the contract or not covered by it. McCabe issued the strike order within an hour after the last man had received a \$50 Christmas bonus from the company as part of a general \$750,000 distribution.

McCabe left for Washington Dec. 17 for a joint conference with Homer Martin, president of the United Automobile Workers, and John L. Lewis, head of the Committee for Industrial Organization. Each was accompanied by two junior officers and it was said they would discuss the automobile labor situation.

It is feared in Toledo that the strike coming on top of the two weeks' shutdown at Ottawa, Ill., and also the two months' closing of five Pittsburgh plate glass plants may have serious effects on the automobile industry. It was estimated that 85 per cent of the safety glass, 70 per cent of the window glass and 93 per cent of the plate glass supply of the country is now cut off.

The Toledo industrial peace board moved immediately to try to mediate differences but the nation-wide extent of the walkout is believed to make that avenue of peace difficult.

John D. Biggers, president of Libbey-Owens-Ford, issued a statement regretting the strike, citing the record of the company in collective bargaining, and making public the text of the proposed agreement.

"The company has at no time discouraged any of its employes from joining any union. At the same time, the company has refused to coerce its workers into joining any particular labor organization. That was the main bone of contention. Mr. McCabe and his committee demanded a closed shop in one form or another.

"Their other demands included the 'check-off' which means collection of union dues, fines and assessments for the union by the company; 10 cents an

hour increase in wages which would cost \$1,210,000; a 25 per cent bonus for straight hourly workers totalling another \$1,498,000; and a long string of fantastic proposals impossible to accept.

"We believe the fairness and liberality of our proposed agreement speaks for itself.

"On top of wages which are now 46 per cent above the national average and in addition to bonuses of \$750,000 previously announced we offered wage increases totalling \$580,000.

"This meant that our factory workers during 1937 would be paid an average of \$1,725, if they worked the same amount of time as this year. This annual pay per employee would compare favorably with any in the United States, and still union leaders ordered a strike."

Libbey-Owens-Ford produces all safety glass for General Motors and some for Packard, Studebaker and Graham-Paige. Large quantities of window glass have also been forwarded to Ford from Shreveport and Charleston.

New AMA Price Policy

(Continued from page 837)

"Effective at once, the members of the Automobile Manufacturers Association will adopt a more simplified method of pricing motor cars. However, the intent of this action is not to change the price the customer will pay, and, except for some very slight modifications incidental to the details of its application, the price the customer pays will remain the same as before.

"In the past, a list price, f.o.b. factory, has been used in advertising. That list price did not include such things as a charge for preparing the car for delivery, reimbursement of federal tax, nor such accessories and extra equipment as the purchaser might have elected to buy.

"Effective at once, the new simplified price will be a 'delivered price' at point of manufacture, which will include the charge for delivery, reimbursement of federal tax, and all essential accessories, such as the spare tire, and bumpers, which are now universally needed by all purchasers and have come to be known as standard equipment. To determine the retail price at any particular point of delivery, it will only be necessary under the new method for the purchaser to add the following charges to the advertised delivered price at the factory city:

- "1. Transportation from point of manufacture to point of delivery;
- "2. State and local taxes—if any—at point of delivery.

"Should the purchaser elect to buy

a more comprehensive group of accessories, these will be available at prices to be quoted by the dealer.

"This pricing policy will go into effect immediately in newspaper advertising and, as soon as it can be accomplished, in national advertising.

"As stated above, this change is one of method only and, although it will cause practically no change in the retail price of the car to the purchaser, the new advertising will make it possible for the prospective buyer to determine more closely the total price of any particular car."

While the Ford Motor Co., which is not a member of the AMA, has not yet issued any statement, it was generally understood that it would adhere to the same policy in quoting prices of its cars.

UAW Aids Bus Strikers

Drivers, Suspended by A. F. of L., Turn to Automobile Union

Flint bus drivers, on strike since Dec. 8 were suspended from the Amalgamated Association of Street Electric Railway and Motor Coach Employees of America for failure to arbitrate their wage dispute before quitting work and for disregarding the union's order to return to work Monday morning. Strikers turned to the United Automobile Workers Union for assistance and so the strike has turned into a three-cornered dispute between two types of unions, between employer and employee, and between company and city authorities.

The Amalgamated is an A. F. of L. craft union, whereas the UAW is allied with the John L. Lewis Committee for Industrial Organization. Officials of the former offered to help the coach company get men to replace the strikers, this offer being severely criticized by a UAW official who said: "We are not in favor of scabs of any kind—union or non-union scabs." The UAW denies that a contract between strikers and the company exists because no new agreement was made when drivers stopped working for the Eastern Michigan system receiver and became trolley coach employees. This contract provided for arbitration of wage disputes and the A. F. of L. bus union held the men had no reason to strike until they had resorted to this means of settlement.

British Firm Builds Light Diesel Truck

British truck manufacturers have hitherto used only gasoline engines in their endeavors to provide a complete truck for 5-ton loads within the maximum unladen weight limit allowed for a legal speed of 30 m.p.h. But a new Garner truck is announced with a Diesel type engine without exceeding the weight limit of 2½ long tons.

On three lengths of wheelbase rang-

ing up to 164 in., all with driver alongside the engine, a four-cylinder Perkins Leopard oil engine is used; it has a bore and stroke of 100 x 127 mm. (3 15/16 x 5 in.) and a speed range from 300 to 3000 r.p.m. The peak of the power curve is at 2400 r.p.m. and 60 b.h.p. The maximum length of body is 195 in. Tires are of the reinforced heavy duty type 32 x 6 in., twins at the rear. Brakes are Lockheed hydraulic with a vacuum servo.

To keep within the weight limit it is necessary to use a flat platform body with the usual enclosed cab.

Output Half-Million

(Continued from page 837)

cent to 75 per cent ahead of the volume of a year ago. One company delivered 93 per cent more cars in the first 10 days of December than it did in the corresponding period last year. Gains of better than 25 per cent are common and the industry as a whole is likely to show upwards of 25 per cent increase in deliveries over the December volume of 1935.

This strong retail demand presages heavy production throughout the winter months. Probably only the labor situation will govern rate of output since unfilled orders will keep the plants busy until it is time to start stocking dealers for the normally active spring months.

Domestic retail deliveries of Buicks totaled 6672 cars, according to W. F. Hufstader, general sales manager, compared with 5048 in the first 10 days of November and 3459 in the corresponding period of December a year ago. This was an increase of 1624 units or 32 per cent over preceding month and of 3213 units or 92.8 per cent over corresponding 1935 period. As against sales of 6672 Buicks in the first December period this year, 3375 cars were delivered in the comparable period of 1926, 3395 in 1927 and 2782 in 1928. Buick production is expected to reach an all-time high in December with output of approximately 30,000 cars for the month. In only three months in Buick's history was this production approached and in no case was a comparable output reached in a midwinter month. Three previous record months were August and September in 1926 when 29,355 and 29,102 cars were built respectively and August, 1929, when 29,039 Buicks were produced.

Studebaker factory sales of passenger cars and trucks for the first 10 days of December totalled 2440 compared with 1766 in the corresponding period of 1935, according to Paul G. Hoffman, president. This brings the total sales for 1936 to 86,831—79 per cent more than the 48,579 units sold between Jan. 1 and Dec. 10, 1935.

Graham retail sales for the first 10 day in December show a 75 per cent increase over the figures for the similar period in November, 1936, reports F. R. Valpey, vice-president and gen-

eral sales manager of the Graham-Paige Motors Corp. Fourth quarter new car shipments through Dec. 14 of this year are 48 per cent over the entire three months of the final quarter of 1935.

Retail deliveries of Pontiac cars by dealers in the United States for the first 10 days of December were 6979, the largest for that period in the company's history. This compares with 3180 for the same 10-day period of 1935. Production keeps right on increasing as the figures for the week ending Dec. 12 show, during which 6076 cars were built.

During the first 10 days of December Oldsmobile delivered 6739 cars to retail purchasers, an increase of 24.5 per cent over the 5415 cars delivered during the last 10 days of November. This new sales record is an increase of 52 per cent over the same period in 1935, when 4435 Oldsmobiles were delivered to retail buyers. Meanwhile the Oldsmobile plant in Lansing is employing day and night shifts to maintain a production schedule calling for more than 1000 cars daily. It is expected that more than 25,000 cars will be manufactured during the current month.

Sales of Hudsons and Terraplanes are higher in volume than for eight

years at this corresponding time of year, according to William R. Tracy, vice-president in charge of sales. "During the month of November our retail sales totaled 8300 cars. This represents a gain of 99 per cent over October of this year and a gain of 30 per cent over November of last year," stated Tracy. "For the first week in December sales were not only greater than for any corresponding week since 1928, but are higher in volume than since June of this year."

Willys-Overland to Open Los Angeles Plant Dec. 15

Following the start of Willys-Overland Motors, Inc., on a quantity production basis at the Toledo plants Nov. 30, it is announced that production will start at the Los Angeles, Calif., plant on Dec. 15. Production at Toledo will reach 6000 cars during December, and will be stepped up through the next four or five months to provide for the bank of orders already on hand from distributors.

Plans for the opening of the California plant include a dealer meeting of the Pacific Coast and Inter-mountain states with ceremonies at the end of the assembly line.

Automotive Exports Continue Gains

Exports and Imports of the Automotive Industry for October and Ten Months Ended October, 1936-1935

| | OCTOBER | | OCTOBER | | TEN MONTHS ENDED OCTOBER | | | |
|---------------------------------------------------|---------|---------------|---------|---------------|--------------------------|----------------|---------|----------------|
| | 1936 | | 1935 | | 1936 | | 1935 | |
| | No. | Value | No. | Value | No. | Value | No. | Value |
| EXPORTS | | | | | | | | |
| Motor vehicles, parts and accessories..... | | \$ 15,765,849 | | \$ 14,060,959 | | \$ 190,217,962 | | \$ 185,682,820 |
| PASSENGER CARS | | | | | | | | |
| Passenger cars and chassis..... | 9,747 | 6,111,642 | 7,471 | 3,836,701 | 135,392 | 70,996,666 | 133,453 | 74,410,122 |
| Low price range \$850 inclusive..... | 8,607 | 4,816,480 | 6,826 | 3,170,211 | 124,446 | 64,466,525 | 123,512 | 63,730,742 |
| Medium price range over \$850 to \$1,200..... | 900 | 848,537 | 462 | 433,702 | 8,937 | 8,486,629 | 7,305 | 6,923,672 |
| \$1,200 to \$2,000..... | 152 | 226,403 | 73 | 111,410 | 1,397 | 2,062,452 | 1,055 | 1,623,244 |
| Over \$2,000..... | 88 | 216,222 | 36 | 86,380 | 713 | 1,856,060 | 667 | 1,764,552 |
| COMMERCIAL VEHICLES | | | | | | | | |
| Motor trucks, buses and chassis (total)..... | 6,770 | 3,817,561 | 7,109 | 3,714,767 | 88,012 | 45,385,670 | 80,768 | 42,036,665 |
| Under one ton..... | 701 | 306,563 | 932 | 294,606 | 13,426 | 5,141,535 | 7,461 | 2,589,490 |
| One and up to 1½ tons..... | 4,791 | 2,291,183 | 4,844 | 2,133,840 | 56,617 | 27,147,927 | 58,524 | 26,896,543 |
| Over 1½ tons to 2½ tons..... | 1,084 | 672,934 | 1,324 | 937,527 | 11,717 | 6,659,232 | 12,268 | 9,030,980 |
| Over 2½ tons..... | 166 | 321,616 | 279 | 324,809 | 2,375 | 3,527,291 | 2,033 | 3,150,476 |
| Bus chassis..... | 28 | 23,383 | 19 | 20,615 | 1,078 | 906,685 | 230 | 270,690 |
| PARTS, ETC. | | | | | | | | |
| Parts except engines and tires..... | | 2,807,283 | | 3,191,411 | | 33,789,397 | | 38,686,846 |
| Automobile unit assemblies..... | | 341,436 | | 341,749 | | 2,757,384 | | 2,579,263 |
| Automobile accessories (n.e.s.)..... | | 2,363,905 | | 2,308,927 | | 22,190,042 | | 21,662,617 |
| Automobile parts for replacement (n.e.s.)..... | | 440,529 | | 428,621 | | 3,788,336 | | 3,479,262 |
| Airplanes, seaplanes and other aircraft..... | 31 | 719,674 | 30 | 286,042 | 403 | 8,765,613 | 296 | 6,846,616 |
| Parts of airplanes, except engines and tires..... | | 897,194 | | 447,666 | | 5,069,613 | | 4,220,772 |
| INTERNAL COMBUSTION ENGINES | | | | | | | | |
| Stationary and Portable..... | | | | | | | | |
| Diesel and semi-Diesel..... | 31 | 68,956 | 31 | 136,163 | 322 | 912,157 | 260 | 729,842 |
| Other stationary and portable..... | | | | | | | | |
| Not over 10 hp..... | 2,079 | 85,920 | 902 | 61,690 | 10,985 | 633,190 | 8,190 | 474,289 |
| Over 10 hp..... | 206 | 129,859 | 67 | 39,244 | 1,949 | 859,704 | 1,241 | 704,607 |
| Automobile engines for..... | | | | | | | | |
| Motor trucks and buses..... | 494 | 63,358 | 1,006 | 94,576 | 18,411 | 1,804,559 | 4,449 | 670,677 |
| Passenger cars..... | 1,722 | 98,161 | 2,834 | 186,360 | 38,404 | 2,662,078 | 22,028 | 1,421,236 |
| Engines and aircraft..... | 111 | 769,467 | 52 | 255,076 | 727 | 4,126,444 | 464 | 1,944,312 |
| Accessories and parts (carburetors)..... | | 186,126 | | 136,126 | | 1,625,869 | | 1,338,674 |
| IMPORTS | | | | | | | | |
| Automobile and chassis (durable)..... | 228 | 119,772 | 51 | 24,600 | 675 | 426,206 | 465 | 231,103 |

Automotive Metal Markets

Copper Price Forced Higher by Foreign Advance; Strength Spreads to Other Metal Quotations

By William Crawford Hirsch

An advance of half a cent per pound in the price of copper to 11 cents, effective, when it was announced on Monday, not only came as a complete surprise but, accompanied as it was by upward changes in the price of other non-ferrous metals, focused attention on rising material costs as the outstanding problem of the hour. The new price for copper is the highest since March, 1931, and denotes more than 125 per cent advance over the depression low of 4½ cents.

Buying since the preceding advance on Nov. 6 to 10½ cents had been fair, but by no means spectacular; the foreign market price, however, ruled consistently above the home quotation. Uncertainty prevailed as to whether fabricators had been afforded an opportunity to cover at the old price to the extent of their own commitments before the advance became fully effective, but it was hinted in the copper market that producers intended to abolish this custom. Prices on all copper products were forthwith raised to the extent of ½ cent per lb.

A sharp advance in zinc, coming at the same time as did the rise in copper, served to harden prices for brass and other non-ferrous alloys still further. Ferrous alloys were also marked up, ferromanganese being raised \$5 and silicomanganese \$4 a ton. Steel producers were reported to have had to pay 25 to 75 cents more per ton for scrap. Spiegeleisen was also marked up \$2 a ton.

One of the leading steel company executives has come out in advocacy of the steel industry doing away with the granting of extra time when prices are raised. He blamed competitive conditions for this condition, which, according to a guess in one quarter has made possible the placing of steel orders sufficient to build 2,500,000 automobiles in the interval between announcement of higher prices and their going into effect. It is now conceded that some of the sheet mills will be completing and shipping orders, placed at old prices, not only during the first half of the next quarter, but in the latter part of February and to some extent even as late as March.

Pig Iron—Middle West markets are fairly active with the December demand promising to equal the record of November, which was the best since 1928. Encouraging sales for first quarter on the basis of \$20.50 for No. 2 foundry, Detroit, Chicago or Cleveland, are reported to have been booked.

Aluminum—Both primary and secondary metal prices are firm and unchanged. Somewhat larger tonnages are noted coming in from Norway and the Continent. Prices are entirely unchanged.

Copper—London cables on Tuesday quoted electrolytic copper at an advance equivalent to ½ cent, and the so-called "export price" here moved up to 11½ cents. Predictions of 12-cent copper in the near future were freely made.

Tin—Following somewhat easier conditions in the London and Singapore markets, which brought the quotation for spot Straits tin in New York down to 51.85 cents at the beginning of the week, the "bulls" seemingly took fresh courage and on Tuesday spot Straits tin rose to 52½ cents. The rise in the copper market and expectations that the International Tin Committee would again order restrictions in production served to impart a stronger undertone to the market.

Lead—The two leading marketers have raised their contract price by \$4 a ton to 5.50 to 5.55 cents, New York. Sensational advances in London caused the advance, although no lead has of late been shipped to Europe.

Zinc—Following an advance in the zinc market on Monday to the extent of \$2 a ton, a leading producer quoted the next day 5.35 cents, East St. Louis, which denotes a rise of \$4 per ton over the quotation at the end of the preceding week.



A catalog of graphite bronze bearings with a marginal thumb index of standard sizes has just been issued by the Randall Graphite Products Corp., Chicago.*

Latest publication brought out by the Wickwire Spencer Steel Co., New York City, is entitled "A Treatise on Springs, Wire Forms And Spring Wires."*

C. A. Norgren Co., Inc., Denver, Col., recently published a catalog which contains descriptive matter on the Norgren line of pneumatic products.*

Graham Transmissions, Springfield, Vt., has issued a brochure which describes the Graham variable speed transmission.*

Most recent bulletin prepared by the Landis Tool Co., Waynesboro, Pa., gives information on the Landis 5 in. type-C hydraulic piston grinder.*

Chambersburg steam hydraulic forging presses are illustrated and described in Bulletin No. 300 which the Chambersburg Engineering Co., Chambersburg, Pa., now has available for distribution.*

The Niagara Machine & Tool Works, Buffalo, N. Y., has just published Bulletin 64E, which illustrates and describes the Niagara line of double crank presses.*

A new stock drive bulletin has been brought out by the Morse Chain Co., Ithaca, N. Y.*

The Brown Instrument Co., Philadelphia, has prepared a new catalog (No. 6708), which covers the complete line of Brown thermometers and pressure gages, and enumerates the industries to which they are applicable.*

Metalgrams 16 and 16A, compiled and published by the Apex Smelting Co., Chicago, are the first of a short series which will show graphically the effect of Tin and Lead contamination on Zinc-base die casting alloys Nos. 3 and 5.*

"The New Arc Welding Technique" is the title of the latest brochure issued by the Lincoln Electric Co., Cleveland, Ohio.*

Five new booklets on Enduro stainless steel have just been released by the Republic Steel Corp., Cleveland, Ohio. Much information of value, including useful tables is included.*

The Cornell Iron Works, Inc., Long Island City, N. Y., has just published an 8-page catalog which contains information on the Cornell rolling doors and shutters, hand and motor operated.*

The Brown Instrument Co., Philadelphia, Pa., has published a handbook on flow meter engineering covering every phase of flow meter engineering principles, designs, applications and installation. All theory is illustrated with charts, photographs and sample problems. The handbook contains 164 pages and is bound in leather. Available from the company at the price of \$2.00.

*Obtainable from Editorial Department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Streets, Philadelphia, Pa.

Autocar Dividend

The board of directors of the Autocar Co. has declared a dividend of 75 cents a share on the company's preferred stock, payable Dec. 26 to stockholders of record as of Dec. 19. Reports disclosed steadily rising sales and profits.

Calendar of Coming Events

SHOWS

- National Motor Boat Show, New York, Jan. 8-16
- First International Consumers' Petroleum Exposition, Detroit, Jan. 16-24
- Illinois Automotive Ass'n, 4th Annual Show and Maintenance Exhibit, Navy Pier, Chicago, Apr. 24-28, 1937
- Second Annual Automotive Maintenance Show, San Francisco, May 20-23

CONVENTIONS AND MEETINGS

- Tin Can Tourists' Homecoming, Arcadia, Fla., Dec. 28, 1936-Jan. 3, 1937
- S.A.E. Annual Meeting, Detroit, Mich., Jan. 11-15, 1937
- American Road Builders Association, Highway Exhibit and Convention, New Orleans, Jan. 11-15
- Tin Can Tourists' Winter Convention, Clearwater, Fla., Jan. 29-Feb. 8, 1937
- Tin Can Tourists' Winter Convention, Sarasota, Fla., Feb. 8-14, 1937
- Association of Highway Officials of No. Atlantic States, 13th Annual Convention, New York, Feb. 24-26

- International Association for Testing Materials, Second International Congress, London, England, April 19-24, 1937
- American Society for Testing Materials, 937 Regional Meeting and Committee Week, Palmer House, Chicago, March 1-5
- 41st Annual Convention and Exposition of the American Foundrymen's Association, Milwaukee, beginning May 2, 1937
- American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Col., June 1-3
- Second World Petroleum Congress, Paris, France, June 14-19

CONTESTS

- Los Angeles Raceway, 500-Mile International Sweepstakes, March 28
- Indianapolis Speedway, 500-Mile International Sweepstakes, May 31
- Pan American Cup Race, Roosevelt Raceway, July 5
- Roosevelt Raceway, 400-Mile George Vanderbilt Cup Sweepstakes, Sept. 6
- Los Angeles, 2nd 500-Mile International Sweepstakes, Nov. 28



Engine assembly line at the Chrysler plant. It is "U" shaped and measures 193 ft. by 240 ft. with 480 ft. of conveyors

Production Lines

anism removes all heavy spring pressure. Moreover, the automatic clutch makes it possible to start from the curb, preselecting forward, without using the clutch pedal. For those who like gadgets, they will supply a dash instrument consisting of a panel containing a circle of glass buttons, each one marked for a given speed position, and lighting up as the gear change is made.

Without Price

We thought that we had a fairly good notion of the real usefulness of the machine tool industry to the metal cutting industry. But we ran into a situation that has given us an entirely fresh slant. Here is the case of a parts maker producing a specialty which requires special machinery, usually designed, patented, and built by the users. Over a period of years, such parts makers have grown away from the intimate contact with the machinery engineers and consequently have not been exposed to the flood of new ideas and principles upon which the majority of the automotive industry has grown to rely. Today, this particular manufacturer feels the situation keenly and is making a determined effort to modernize immediately so as to conform to the best there is of modern metal cutting practice. It seems evident that the constant clearing of new ideas by contact with machinery engineers is the very basis on which the industry's master mechanics continue to create the marvelous progress that we have grown to accept as a matter of course.

Positive Oiling

On occasion we have noted the unquestioned trend to the automatic lubrication of machine tools. Apart from a reduction of maintenance cost, automatic lubrication assures the safety of expensive equipment by preventing shut-down at a time when any interruption might be almost fatal so far as operating schedules are concerned.

Automatic oiling systems have been making their appearance in recent years, more or less sporadically on new items of equipment; also as attachments on older machines. We can report that two of the largest stamping plants in the industry are completely protected by automatic lubrication. Every press and every item of other production machinery is fitted with a built-in oiling system.

Vaco Shift

Several days ago we had an opportunity to drive a car fitted with the special dash control, vacuum gear shifting device at which we have hinted on many occasions. This gear shifter differs quite radically from the others on the market in at least one respect. It is designed to be preselective so that gear changes are made upon clutch manipulation but without touching the control lever. There is a shift control lever mounted on the steering column, having only two positions—forward and reverse. You place the lever in forward position and shifts are made automatically from that point on, simply by manipulation of the clutch pedal. An extra lever position is added for optional second to permit shifting into second at will. Reverse may be preselected while the car is in motion but the shift can't take place until the car has come to a positive stop. Shifts are clean and absolutely noiseless. The company making the shifter also makes an interesting sucker clutch control, using a button alongside the clutch pedal. Use of the button simplifies clutch operation since the servo mech-

Low Alloys

A. E. Gibson, president of the American Welding Society, and v.-p., Wellman Engineering Co., had an interesting message for welding men recently. He covered in detail the work of his company in designing and building various types of structures by welding techniques using suitable grades of low alloy steels. These are the comparatively new materials developed by a number of the leading steel makers. The steels comprise combinations of copper-nickel, copper-nickel-moly, and variations including chromium as well as varying percentages of carbon. The nickel alloys range from a minimum of 0.75 per cent to 2 per cent. The principal usefulness of these materials lies in their high physical properties as compared with the ordinary structural steels, providing an increase of about 100 per cent in this respect. This makes it possible to build structures of a given factor of safety at about half the weight. Copper is used in these alloys because of susceptibility to heat treatment, producing precipitation hardness which in turn has a bearing on the maximum physical properties of the structure. —J. G.

Available publications sometimes mentioned on this page will henceforth be found regularly under "Publications Available." See page 846 in this issue.

MANUFACTURING
MANAGEMENT
METALLURGY

The 250 Major Wholesale

Parts and accessory manufacturers must look to jobber outlets to supply volume for 1937 season

By Marcus Ainsworth

BEFORE the relative importance of the leading wholesale automotive markets can be determined accurately, the normal trading areas comprising these markets must be established. Once this is done, it is possible to measure each market in terms of the factors which have an influence on the sale of maintenance merchandise within its boundaries.

In compiling the latest survey of major wholesale markets, as published on the following pages, it was able to determine the physical size of each market analyzed through the unstinting cooperation of hundreds of wholesalers, large and small, in every part of the United States.

These wholesalers reported on the counties surrounding their home city in which they travel salesmen regularly. Careful allowance was made for any influence on the size of territories by some of the larger houses with abnormal coverage and each market presented on the following pages represents what has been found to be the normal area covered by the average wholesaler in that market.

In studying the figures presented on the following pages it must be kept in mind, therefore, that although the markets are identified in terms of the cities which represent their jobbing centers, the figures actually cover the counties comprising the normal wholesale marketing areas of those cities.

The most important factor to be found in determining the relative importance of any given wholesale auto-

motive market is the number of motor vehicles registered in that market. They represent the maximum sales potential for maintenance merchandise. In this study the registration figures are broken down to show the number of passenger cars and trucks and are further broken down to show Ford and Chevrolet—and all others, in both the passenger car and truck classification.

Other factors enter in to modify the

stores. Fleets of five or more vehicles owned and serviced in the area also are shown.

The number of automotive wholesalers doing business in each marketing area is presented. These represent the competition which any particular wholesaler must face when his salesmen call on the retail outlets in the area. Here again it must be kept in mind that the number of wholesalers indicated means the number with headquarters in that particular area, not necessarily in the same city. Many marketing areas overlap, so this also must be kept in mind.

Car and truck distributors and branches in each area are shown also because they are factors in the distribution to other outlets of certain types of maintenance merchandise.

We are indebted to *Sales Management* for permission to use figures on "spendable money income" as developed in its 1936 "Survey of Spending Power." These figures again are broken down to follow the same county lines used on the automotive statistics. According to *Sales Management*:

"Spendable money income is the money actually paid out during the calendar year for goods and services produced and rendered, plus

Federal allotments, and moneys paid out of savings and surpluses of business institutions. Spendable money income answers the question, 'How much money is there to spend—and where?'"

All trade outlet information was taken from the Chilton Trade List.



potential sales opportunity, however. The number of retail establishments in each marketing area is shown, broken down as to car and truck dealers or independent repair shops and accessory

Markets

(Not cities alone but the normal trading areas they serve are represented by these figures)

ZONE 1

Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut

| STATE | REGISTRATIONS December 31, 1935 | | | | | Percentage of Total U. S. Motor Vehicle Registrations | RETAIL TRADE ESTABLISHMENTS July, 1936 | | | | WHOLE- SALEERS July, 1936 | | Car and Truck Dist. and Branches—July, 1936 | FLEETS July, 1936 | | Percentage of Total U. S. Spendable Money Income 1935 |
|------------------|------------------------------------|---------------|--------------------------|---------------|-------------------------|----------------------------------------------------------|----------------------------------------------|------------------------------------------------|--------------------|-----------------------------------------------------------|---------------------------------|--------------------------------------------------------|------------------------------------------------|------------------------------|-------------------------------------------|-------------------------------------------------------------|
| | Passenger Cars | | Trucks | | Total Motor Vehicles | | Car and Truck Dealers | Garages, Repair Shops and Access. Stores | Total Retail Units | Percentage of Total U. S. Automotive Retail Outlets | All Wholesalers | Percentage of Total U. S. Automotive Wholesalers | | Fleets—5 or More Vehicles | Percentage of Total U. S. Fleet Owners | |
| | Ford and Chevrolet | All Others | Ford and Chevrolet | All Others | | | | | | | | | | | | |
| CONNECTICUT | | | | | | | | | | | | | | | | |
| Bridgeport..... | 127,772 | 173,137 | 27,274 | 19,463 | 347,646 | 1.31 | 459 | 833 | 1,292 | 1.24 | 94 | 1.60 | 10 | 521 | 1.78 | 1.6455 |
| Hartford..... | 56,967 | 70,534 | 15,329 | 9,860 | 152,687 | .57 | 285 | 307 | 592 | .57 | 35 | .60 | 5 | 236 | .81 | .6172 |
| New Haven..... | 138,353 | 170,935 | 34,617 | 23,187 | 367,092 | 1.38 | 571 | 791 | 1,362 | 1.31 | 108 | 1.84 | 11 | 643 | 2.20 | 1.5565 |
| Stamford..... | 88,730 | 122,248 | 16,326 | 11,937 | 239,241 | .90 | 298 | 579 | 877 | .84 | 60 | 1.02 | 7 | 319 | 1.09 | 1.1486 |
| Waterbury..... | 44,805 | 58,294 | 12,650 | 8,684 | 124,433 | .47 | 210 | 293 | 503 | .46 | 36 | .61 | 3 | 214 | .73 | .5477 |
| MAINE | | | | | | | | | | | | | | | | |
| Bangor..... | 33,626 | 35,680 | 10,300 | 6,152 | 85,758 | .32 | 238 | 348 | 586 | .56 | 18 | .31 | 9 | 41 | .14 | .2054 |
| Lewiston..... | 24,123 | 24,984 | 7,926 | 4,793 | 61,826 | .23 | 109 | 179 | 288 | .28 | 15 | .26 | 4 | 36 | .12 | .1410 |
| Portland..... | 42,105 | 44,306 | 10,446 | 9,278 | 112,135 | .42 | 171 | 264 | 435 | .42 | 33 | .56 | 6 | 107 | .37 | .2596 |
| MASSACHUSETTS | | | | | | | | | | | | | | | | |
| Boston..... | 302,604 | 324,719 | 60,178 | 36,162 | 723,683 | 2.72 | 1,013 | 1,422 | 2,435 | 2.34 | 218 | 3.71 | 16 | 1,355 | 4.64 | 4.0687 |
| Fall River..... | 99,549 | 112,575 | 20,696 | 13,484 | 246,304 | .93 | 335 | 570 | 905 | .87 | 63 | 1.07 | 6 | 466 | 1.60 | 1.0516 |
| Greenfield..... | 93,902 | 106,717 | 18,669 | 12,005 | 231,293 | .87 | 433 | 567 | 1,000 | .96 | 73 | 1.24 | 12 | 343 | 1.17 | 1.0746 |
| Holyoke..... | 46,755 | 57,692 | 8,629 | 5,852 | 110,927 | .45 | 221 | 308 | 529 | .51 | 35 | .60 | 10 | 190 | .66 | .5936 |
| Lowell..... | 138,671 | 148,749 | 26,162 | 15,597 | 329,379 | 1.24 | 510 | 718 | 1,228 | 1.18 | 81 | 1.36 | 6 | 476 | 1.64 | 1.5549 |
| New Bedford..... | 57,795 | 58,257 | 12,516 | 7,069 | 135,627 | .51 | 214 | 299 | 513 | .49 | 36 | .61 | 2 | 211 | .72 | .5555 |
| Pittsfield..... | 42,548 | 50,371 | 10,063 | 6,505 | 109,537 | .41 | 238 | 351 | 589 | .57 | 24 | .41 | 4 | 104 | .36 | .4033 |
| Springfield..... | 46,755 | 57,692 | 8,628 | 5,852 | 110,927 | .45 | 221 | 308 | 529 | .51 | 35 | .60 | 10 | 190 | .66 | .5936 |
| Worcester..... | 116,552 | 125,576 | 21,141 | 13,037 | 276,308 | 1.04 | 416 | 543 | 959 | .92 | 71 | 1.21 | 1 | 466 | 1.60 | 1.3561 |
| NEW HAMPSHIRE | | | | | | | | | | | | | | | | |
| Manchester..... | 53,018 | 49,225 | 15,402 | 8,078 | 125,723 | .47 | 289 | 399 | 688 | .66 | 27 | .46 | 7 | 54 | .18 | .3171 |
| RHODE ISLAND | | | | | | | | | | | | | | | | |
| Providence..... | 282,436 | 286,719 | 52,024 | 32,961 | 654,140 | 2.46 | 984 | 1,347 | 2,331 | 2.24 | 158 | 2.66 | 8 | 1,072 | 3.67 | 2.8530 |
| VERMONT | | | | | | | | | | | | | | | | |
| Burlington..... | 19,600 | 19,565 | 2,845 | 1,585 | 43,595 | .16 | 89 | 207 | 296 | .26 | 13 | .22 | 2 | 20 | .07 | .1410 |

ZONE 2

New York, Pennsylvania and New Jersey

| | | | | | | | | | | | | | | | | |
|---------------------------|---------|-----------|---------|---------|-----------|------|-------|-------|-------|------|-----|------|----|-------|-------|---------|
| NEW JERSEY | | | | | | | | | | | | | | | | |
| Atlantic City..... | 26,189 | 27,719 | 9,236 | 5,162 | 68,305 | .26 | 115 | 187 | 302 | .29 | 23 | .39 | 1 | 142 | .49 | .2161 |
| Camden..... | 44,309 | 42,090 | 10,714 | 5,793 | 102,906 | .39 | 155 | 222 | 377 | .36 | 12 | .20 | 2 | 110 | .36 | .3413 |
| Elizabeth..... | 121,389 | 162,083 | 24,882 | 17,917 | 326,271 | 1.23 | 306 | 810 | 1,116 | 1.07 | 69 | 1.17 | 9 | 550 | 1.88 | 1.5920 |
| Jersey City..... | 33,443 | 45,160 | 8,417 | 5,961 | 92,981 | .35 | 73 | 286 | 359 | .34 | 17 | .29 | 6 | 213 | .73 | .5499 |
| Long Branch..... | 120,787 | 138,004 | 26,393 | 16,242 | 301,426 | 1.13 | 441 | 770 | 1,211 | 1.16 | 54 | .92 | 6 | 391 | 1.34 | 1.0344 |
| Newark..... | 271,893 | 344,993 | 59,212 | 40,679 | 716,777 | 2.70 | 798 | 1,833 | 2,619 | 2.62 | 143 | 2.43 | 10 | 1,130 | 3.87 | 3.2256 |
| Paterson..... | 82,482 | 102,419 | 15,975 | 11,019 | 211,895 | .80 | 263 | 575 | 841 | .81 | 37 | .63 | 2 | 229 | .76 | .7613 |
| Trenton..... | 90,493 | 94,320 | 22,768 | 13,066 | 220,637 | .83 | 380 | 539 | 919 | .88 | 36 | .61 | 4 | 295 | 1.01 | .6831 |
| NEW YORK | | | | | | | | | | | | | | | | |
| Albany..... | 63,235 | 103,080 | 20,526 | 13,992 | 220,842 | .83 | 362 | 707 | 1,069 | 1.05 | 57 | .97 | 11 | 218 | .76 | .6831 |
| Binghamton..... | 53,453 | 58,132 | 14,219 | 8,407 | 134,211 | .50 | 334 | 437 | 771 | .74 | 27 | .46 | 8 | 93 | .32 | .3916 |
| Brooklyn..... | 206,875 | 283,182 | 48,767 | 38,404 | 677,220 | 2.17 | 855 | 1,516 | 2,171 | 2.00 | 150 | 2.55 | 9 | 972 | 3.33 | 4.5928 |
| Buffalo..... | 145,215 | 148,671 | 27,596 | 16,395 | 337,715 | 1.27 | 850 | 702 | 1,252 | 1.20 | 63 | 1.07 | 11 | 496 | 1.69 | 1.4000 |
| Cortland..... | 40,329 | 47,475 | 9,026 | 6,804 | 102,634 | .39 | 180 | 294 | 474 | .46 | 27 | .46 | 8 | 99 | .34 | .3368 |
| Elmira..... | 53,535 | 63,924 | 11,476 | 7,273 | 136,208 | .51 | 256 | 379 | 635 | .61 | 32 | .54 | 8 | 106 | .36 | .4472 |
| Ithaca..... | 23,670 | 25,866 | 5,089 | 3,166 | 58,011 | .22 | 118 | 175 | 293 | .28 | 9 | .15 | 1 | 31 | .11 | .1832 |
| Jamestown..... | 25,008 | 25,890 | 6,022 | 3,540 | 60,460 | .22 | 149 | 199 | 346 | .33 | 12 | .20 | 4 | 41 | .14 | .2186 |
| Middletown..... | 26,215 | 32,194 | 8,530 | 5,520 | 74,469 | .26 | 177 | 276 | 453 | .44 | 20 | .34 | 4 | 51 | .17 | .2469 |
| Mt. Vernon..... | 54,700 | 55,304 | 9,982 | 7,644 | 157,630 | .59 | 215 | 404 | 619 | .59 | 35 | .60 | 4 | 158 | .64 | .7966 |
| New York, Man.-Bronx..... | 674,145 | 1,007,123 | 166,231 | 126,657 | 1,076,156 | 7.43 | 1,982 | 4,654 | 6,636 | 6.36 | 470 | 8.00 | 37 | 3,510 | 12.04 | 15.6992 |
| Oneonta..... | 53,209 | 59,049 | 13,175 | 8,121 | 133,553 | .50 | 276 | 419 | 697 | .67 | 28 | .46 | 9 | 109 | .37 | .3963 |
| Plattsburgh..... | 27,287 | 28,675 | 6,737 | 4,092 | 66,791 | .25 | 139 | 203 | 342 | .33 | 22 | .37 | 3 | 31 | .11 | .2256 |
| Poughkeepsie..... | 50,269 | 56,995 | 15,053 | 9,897 | 131,914 | .50 | 297 | 451 | 746 | .72 | 30 | .51 | 5 | 91 | .31 | .4175 |
| Rochester..... | 83,151 | 85,850 | 16,472 | 9,383 | 194,856 | .73 | 334 | 471 | 805 | .77 | 36 | .61 | 10 | 151 | .62 | .7256 |
| Schenectady..... | 40,367 | 47,468 | 8,931 | 5,662 | 102,448 | .39 | 180 | 300 | 480 | .46 | 22 | .37 | 2 | 77 | .26 | .3603 |
| Staten Island..... | 77,840 | 111,392 | 16,175 | 11,693 | 217,100 | .82 | 212 | 592 | 804 | .77 | 33 | .56 | 12 | 334 | 1.14 | 1.0681 |
| Syracuse..... | 85,397 | 99,285 | 18,098 | 10,965 | 203,745 | .77 | 344 | 589 | 933 | .90 | 52 | .88 | 12 | 197 | .67 | .7735 |
| Troy..... | 106,463 | 130,456 | 27,246 | 18,316 | 282,483 | 1.06 | 501 | 898 | 1,399 | 1.34 | 72 | 1.23 | 15 | 262 | .90 | 1.0956 |
| Utica..... | 40,657 | 46,550 | 10,851 | 6,380 | 115,368 | .43 | 229 | 306 | 515 | .59 | 29 | .49 | 6 | 88 | .30 | .3684 |
| PENNSYLVANIA | | | | | | | | | | | | | | | | |
| Allentown..... | 145,148 | 173,248 | 38,135 | 21,489 | 377,990 | 1.42 | 776 | 747 | 1,523 | 1.46 | 85 | 1.46 | 10 | 537 | 1.84 | 1.3772 |
| Altoona..... | 43,338 | 47,446 | 10,680 | 5,719 | 107,162 | .40 | 285 | 326 | 613 | .59 | 28 | .46 | 6 | 112 | .38 | .3549 |
| Easton..... | 53,987 | 61,020 | 15,500 | 8,807 | 140,022 | .53 | 318 | 283 | 601 | .58 | 32 | .54 | 4 | 192 | .66 | .4624 |
| Erie..... | 43,901 | 41,227 | 8,874 | 4,767 | 96,758 | .37 | 204 | 229 | 433 | .42 | 25 | .43 | 6 | 96 | .34 | .3531 |
| Harrisburg..... | 116,336 | 130,516 | 33,363 | 17,959 | 298,178 | 1.12 | 652 | 704 | 1,356 | 1.30 | 73 | 1.24 | 17 | 399 | 1.37 | .6971 |
| Hazleton..... | 50,650 | 63,694 | 14,585 | 8,244 | 137,073 | .52 | 300 | 261 | 561 | .54 | 30 | .51 | 5 | 223 | .76 | .5512 |

ZONE 2—Continued

New York, Pennsylvania and New Jersey

| STATE | REGISTRATIONS December 31, 1935 | | | | | Percentage of Total U. S. Motor Vehicle Registrations | RETAIL TRADE ESTABLISHMENTS July, 1936 | | | | WHOLE- SALEERS July, 1936 | | Car and Truck Dist. and Branches—July, 1936 | FLEETS July, 1936 | | Percentage of Total U. S. Spendable Money Income 1935 |
|-------------------|------------------------------------|---------------|--------------------------|---------------|----------------------------|----------------------------------------------------------|----------------------------------------------|------------------------------------------------|--------------------|-----------------------------------------------------------|---------------------------------|--------------------------------------------------------|------------------------------------------------|------------------------------|-------------------------------------------|-------------------------------------------------------------|
| | Passenger Cars | | Trucks | | Total Motor Vehicles | | Car and Truck Dealers | Garages, Repair Shops and Access. Stores | Total Retail Units | Percentage of Total U. S. Automotive Retail Outlets | All Wholesalers | Percentage of Total U. S. Automotive Wholesalers | | Fleets—5 or More Vehicles | Percentage of Total U. S. Fleet Owners | |
| | Ford and Chevrolet | All Others | Ford and Chevrolet | All Others | | | | | | | | | | | | |
| PENNA.—Contd. | | | | | | | | | | | | | | | | |
| Johnstown..... | 80,250 | 82,047 | 17,252 | 9,013 | 188,562 | .71 | 493 | 509 | 1,002 | .96 | 47 | .80 | 7 | 170 | .58 | .6737 |
| Lancaster..... | 90,070 | 100,422 | 25,435 | 13,688 | 229,615 | .86 | 411 | 498 | 909 | .67 | 56 | .95 | 12 | 311 | 1.06 | .7843 |
| Philadelphia..... | 350,341 | 417,850 | 86,155 | 51,879 | 906,225 | 3.41 | 1,199 | 2,651 | 3,850 | 3.70 | 187 | 3.18 | 16 | 1,466 | 5.12 | 4.7895 |
| Pittsburgh..... | 259,791 | 277,770 | 50,688 | 28,483 | 616,732 | 2.32 | 1,174 | 1,527 | 2,701 | 2.60 | 145 | 2.47 | 29 | 844 | 2.89 | 2.8066 |
| Pottsville..... | 46,806 | 58,279 | 14,596 | 8,074 | 129,755 | .49 | 311 | 227 | 538 | .52 | 34 | .58 | 7 | 144 | .49 | .4346 |
| Reading..... | 124,625 | 144,534 | 33,487 | 18,386 | 321,032 | 1.21 | 643 | 689 | 1,332 | 1.28 | 78 | 1.33 | 11 | 413 | 1.41 | 1.0688 |
| Seranton..... | 72,798 | 81,203 | 20,275 | 10,728 | 185,004 | .70 | 410 | 427 | 837 | .80 | 36 | .61 | 8 | 349 | 1.19 | .7546 |
| Uniontown..... | 68,014 | 57,715 | 13,380 | 6,327 | 145,436 | .55 | 388 | 347 | 735 | .71 | 29 | .49 | 4 | 112 | .38 | .5601 |
| Wilkes-Barre..... | 97,884 | 112,935 | 28,825 | 15,536 | 255,180 | .96 | 593 | 562 | 1,155 | 1.11 | 53 | .90 | 13 | 422 | 1.44 | .9643 |
| Williamsport..... | 45,966 | 49,695 | 12,991 | 6,900 | 115,552 | .43 | 292 | 269 | 561 | .54 | 29 | .49 | 9 | 101 | .35 | .3204 |
| York..... | 32,609 | 31,300 | 7,033 | 3,545 | 74,487 | .20 | 161 | 140 | 301 | .29 | 12 | .20 | 2 | 75 | .26 | .2190 |

ZONE 3

Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, Georgia, Florida and West Virginia

| | | | | | | | | | | | | | | | | |
|--------------------|---------|---------|--------|--------|---------|------|-----|-----|-------|------|----|------|----|-----|------|--------|
| DELAWARE | | | | | | | | | | | | | | | | |
| Wilmington..... | 67,122 | 62,932 | 19,015 | 10,369 | 159,438 | .60 | 262 | 356 | 618 | .69 | 35 | .60 | 1 | 282 | .86 | .5475 |
| DIST. of COLUMBIA | | | | | | | | | | | | | | | | |
| Washington..... | 137,474 | 118,244 | 22,354 | 11,508 | 289,580 | 1.09 | 350 | 350 | 700 | .67 | 34 | .58 | 2 | 304 | 1.04 | 1.0094 |
| FLORIDA | | | | | | | | | | | | | | | | |
| Gainesville..... | 13,524 | 5,491 | 3,763 | 1,222 | 24,000 | .09 | 49 | 55 | 104 | .10 | 11 | .19 | .. | 11 | .04 | .0555 |
| Jacksonville..... | 20,706 | 19,018 | 5,263 | 2,903 | 47,892 | .18 | 55 | 107 | 162 | .16 | 17 | .29 | 7 | 66 | .23 | .1795 |
| Miami..... | 28,237 | 31,637 | 5,162 | 3,738 | 68,804 | .26 | 49 | 164 | 213 | .20 | 16 | .27 | 3 | 93 | .32 | .1879 |
| Tampa..... | 65,664 | 54,744 | 16,251 | 7,690 | 144,346 | .54 | 195 | 303 | 498 | .48 | 46 | .78 | 5 | 185 | .56 | .3212 |
| GEORGIA | | | | | | | | | | | | | | | | |
| Atlanta..... | 165,246 | 89,553 | 33,195 | 12,569 | 300,563 | 1.13 | 415 | 546 | 963 | .93 | 66 | 1.12 | 12 | 299 | 1.02 | 1.1001 |
| Augusta..... | 31,225 | 10,920 | 5,062 | 1,556 | 48,763 | .18 | 65 | 80 | 145 | .14 | 7 | .12 | 1 | 28 | .10 | .1374 |
| Columbus..... | 14,127 | 7,731 | 2,740 | 969 | 25,597 | .10 | 35 | 47 | 82 | .08 | 9 | .15 | 1 | 24 | .08 | .0962 |
| Macon..... | 58,587 | 22,414 | 13,546 | 4,179 | 98,725 | .37 | 198 | 229 | 418 | .40 | 19 | .32 | 2 | 46 | .16 | .3266 |
| Savannah..... | 17,674 | 9,303 | 3,900 | 1,330 | 32,207 | .12 | 44 | 47 | 91 | .09 | 4 | .07 | 4 | 35 | .12 | .1213 |
| MARYLAND | | | | | | | | | | | | | | | | |
| Baltimore..... | 150,878 | 139,599 | 31,126 | 17,421 | 339,024 | 1.27 | 438 | 562 | 1,020 | .98 | 59 | 1.00 | 9 | 546 | 1.87 | 1.3125 |
| NORTH CAROLINA | | | | | | | | | | | | | | | | |
| Asheville..... | 17,768 | 11,657 | 5,210 | 2,275 | 36,910 | .14 | 56 | 85 | 141 | .14 | 7 | .12 | 1 | 31 | .11 | .1310 |
| Charlotte..... | 80,775 | 34,275 | 14,386 | 5,151 | 134,587 | .51 | 166 | 164 | 320 | .31 | 23 | .39 | 4 | 107 | .37 | .4082 |
| Greensboro..... | 58,591 | 24,331 | 12,352 | 4,170 | 99,444 | .37 | 100 | 133 | 241 | .23 | 18 | .31 | 5 | 74 | .25 | .3196 |
| Raleigh..... | 61,317 | 24,717 | 17,838 | 5,842 | 109,172 | .41 | 125 | 111 | 229 | .22 | 21 | .36 | 2 | 60 | .21 | .3002 |
| Wilmington..... | 14,771 | 5,019 | 6,608 | 1,462 | 27,860 | .10 | 35 | 32 | 67 | .08 | 5 | .08 | 2 | 16 | .05 | .0778 |
| Winston-Salem..... | 74,132 | 30,762 | 15,742 | 5,388 | 129,044 | .47 | 138 | 174 | 312 | .30 | 22 | .37 | 5 | 88 | .30 | .3932 |
| SOUTH CAROLINA | | | | | | | | | | | | | | | | |
| Charleston..... | 83,683 | 36,517 | 12,731 | 4,324 | 137,255 | .52 | 134 | 160 | 294 | .28 | 26 | .44 | 3 | 79 | .27 | .3029 |
| Columbia..... | 74,234 | 29,806 | 10,409 | 3,458 | 117,909 | .44 | 107 | 131 | 238 | .23 | 15 | .26 | 3 | 46 | .16 | .2236 |
| Florence..... | 48,984 | 16,464 | 7,512 | 2,284 | 75,244 | .28 | 100 | 85 | 185 | .18 | 12 | .20 | .. | 18 | .06 | .1631 |
| Greenville..... | 116,845 | 42,282 | 14,478 | 4,713 | 178,318 | .57 | 155 | 245 | 400 | .38 | 19 | .32 | 2 | 83 | .26 | .3804 |
| VIRGINIA | | | | | | | | | | | | | | | | |
| Danville..... | 22,512 | 7,540 | 4,769 | 1,408 | 36,229 | .14 | 52 | 51 | 103 | .10 | 7 | .12 | .. | 23 | .08 | .0623 |
| Lynchburg..... | 25,997 | 11,442 | 4,888 | 1,739 | 44,066 | .17 | 65 | 94 | 159 | .15 | 9 | .15 | .. | 32 | .11 | .1106 |
| Norfolk..... | 33,653 | 20,525 | 6,549 | 2,626 | 63,355 | .24 | 86 | 157 | 243 | .23 | 11 | .19 | 6 | 104 | .36 | .2441 |
| Portsmouth..... | 30,271 | 16,921 | 6,349 | 2,350 | 55,891 | .21 | 76 | 120 | 196 | .19 | 10 | .17 | 6 | 97 | .33 | .2145 |
| Richmond..... | 109,412 | 48,726 | 21,945 | 8,235 | 186,316 | .71 | 307 | 467 | 774 | .74 | 41 | .70 | 4 | 151 | .52 | .5495 |
| Roanoke..... | 30,259 | 19,322 | 6,442 | 2,847 | 58,870 | .22 | 106 | 152 | 258 | .25 | 9 | .15 | 3 | 49 | .17 | .1688 |
| WEST VIRGINIA | | | | | | | | | | | | | | | | |
| Bluefield..... | 27,094 | 16,679 | 5,925 | 2,096 | 54,386 | .20 | 120 | 119 | 239 | .23 | 13 | .22 | 1 | 39 | .13 | .1602 |
| Charleston..... | 43,147 | 40,248 | 10,602 | 5,963 | 99,960 | .38 | 155 | 205 | 360 | .35 | 25 | .43 | 9 | 113 | .39 | .3180 |
| Clarksburg..... | 33,056 | 27,679 | 6,365 | 3,303 | 70,502 | .27 | 165 | 166 | 331 | .32 | 15 | .26 | 2 | 60 | .21 | .1916 |
| Fairmont..... | 26,560 | 23,646 | 4,764 | 2,552 | 57,522 | .22 | 126 | 126 | 254 | .24 | 14 | .24 | 2 | 58 | .20 | .1610 |
| Huntington..... | 24,047 | 20,686 | 5,344 | 2,990 | 52,677 | .20 | 85 | 90 | 175 | .17 | 19 | .32 | 5 | 65 | .22 | .1747 |
| Parkersburg..... | 33,669 | 23,167 | 5,473 | 2,626 | 64,925 | .24 | 131 | 134 | 265 | .25 | 14 | .24 | 2 | 50 | .17 | .1406 |
| Wheeling..... | 128,029 | 112,251 | 21,770 | 11,554 | 273,604 | 1.03 | 589 | 577 | 1,166 | 1.12 | 68 | 1.12 | 19 | 280 | .89 | .9034 |

ZONE 4

Ohio, Indiana, Illinois, Michigan and Wisconsin

| | | | | | | | | | | | | | | | | |
|------------------|---------|---------|--------|--------|---------|------|-----|-------|-------|------|-----|------|----|-------|------|--------|
| ILLINOIS | | | | | | | | | | | | | | | | |
| Chicago..... | 311,078 | 379,004 | 61,854 | 42,239 | 794,175 | 2.99 | 830 | 1,659 | 2,489 | 2.39 | 190 | 3.23 | 10 | 1,938 | 6.63 | 5.6843 |
| Danville..... | 37,026 | 22,636 | 5,784 | 2,379 | 67,725 | .25 | 140 | 164 | 304 | .29 | 12 | .20 | 5 | 57 | .20 | .1949 |
| Decatur..... | 35,439 | 23,900 | 5,963 | 2,740 | 67,951 | .26 | 155 | 171 | 326 | .31 | 17 | .29 | 4 | 65 | .22 | .1735 |
| Joliet..... | 77,133 | 85,954 | 12,370 | 6,803 | 162,060 | .61 | 378 | 383 | 741 | .71 | 38 | .61 | 4 | 154 | .53 | .4846 |
| Peoria..... | 84,055 | 61,488 | 13,884 | 6,347 | 175,774 | .66 | 459 | 395 | 854 | .82 | 30 | .51 | 7 | 153 | .52 | .4770 |
| Quincy..... | 75,438 | 40,722 | 10,926 | 4,460 | 131,544 | .49 | 314 | 426 | 740 | .71 | 24 | .41 | 2 | 54 | .18 | .3030 |
| Rockford..... | 67,642 | 60,384 | 11,988 | 5,620 | 135,822 | .51 | 326 | 266 | 594 | .57 | 32 | .54 | 3 | 121 | .41 | .3702 |
| Springfield..... | 57,647 | 41,796 | 9,666 | 4,530 | 113,839 | .43 | 239 | 316 | 555 | .53 | 27 | .46 | 6 | 109 | .37 | .3306 |

ZONE 4—Continued

Ohio, Indiana, Illinois, Michigan and Wisconsin

| STATE | REGISTRATIONS December 31, 1935 | | | | | Percentage of Total U. S. Motor Vehicle Registrations | RETAIL TRADE ESTABLISHMENTS July, 1936 | | | | WHOLE- SALEERS July, 1936 | | Car and Truck Dist. and Branches—July, 1936 | FLEETS July, 1936 | | Percentage of Total U. S. Spendable Money Income 1935 |
|-------------------|------------------------------------|---------------|--------------------------|---------------|----------------------------|----------------------------------------------------------|----------------------------------------------|------------------------------------------------|-----------------------|-----------------------------------------------------------|---------------------------------|--------------------------------------------------------|------------------------------------------------|------------------------------|-------------------------------------------|-------------------------------------------------------------|
| | Passenger Cars | | Trucks | | Total Motor Vehicles | | Car and Truck Dealers | Garages, Repair Shops and Access. Stores | Total Retail Units | Percentage of Total U. S. Automotive Retail Outlets | All Wholesalers | Percentage of Total U. S. Automotive Wholesalers | | Fleets—5 or More Vehicles | Percentage of Total U. S. Fleet Owners | |
| | Ford and Chevrolet | All Others | Ford and Chevrolet | All Others | | | | | | | | | | | | |
| INDIANA | | | | | | | | | | | | | | | | |
| Evansville..... | 63,407 | 37,977 | 12,522 | 5,042 | 119,246 | .45 | 246 | 262 | 508 | .49 | 27 | .46 | 5 | 99 | .34 | .3027 |
| Fort Wayne..... | 91,018 | 61,807 | 15,747 | 6,797 | 175,369 | .66 | 326 | 432 | 758 | .73 | 40 | .68 | 9 | 148 | .51 | .4070 |
| Indianapolis..... | 139,827 | 115,296 | 31,142 | 14,572 | 300,837 | 1.13 | 370 | 587 | 957 | .92 | 66 | 1.12 | 14 | 342 | 1.17 | .8193 |
| Kokomo..... | 48,551 | 36,566 | 10,493 | 4,503 | 100,113 | .38 | 171 | 207 | 378 | .36 | 30 | .51 | 3 | 92 | .31 | .2484 |
| Lafayette..... | 63,952 | 39,405 | 13,041 | 5,105 | 121,503 | .46 | 286 | 276 | 562 | .52 | 26 | .44 | 5 | 109 | .37 | .2991 |
| Richmond..... | 64,431 | 48,939 | 12,044 | 5,507 | 130,921 | .49 | 238 | 285 | 523 | .50 | 36 | .61 | 7 | 103 | .35 | .2906 |
| South Bend..... | 124,882 | 100,449 | 23,879 | 12,109 | 261,319 | .98 | 487 | 502 | 999 | .96 | 69 | 1.00 | 7 | 283 | .97 | .7582 |
| Terre Haute..... | 116,653 | 66,657 | 22,852 | 8,978 | 215,140 | .81 | 436 | 561 | 1,017 | .98 | 44 | .75 | 10 | 177 | .61 | .5293 |
| MICHIGAN | | | | | | | | | | | | | | | | |
| Bay City..... | 54,556 | 40,166 | 8,673 | 4,033 | 107,428 | .40 | 239 | 215 | 454 | .44 | 20 | .34 | 13 | 102 | .35 | .2849 |
| Detroit..... | 291,999 | 270,828 | 35,655 | 19,724 | 618,206 | 2.32 | 559 | 933 | 1,492 | 1.43 | 82 | 1.40 | 6 | 848 | 2.90 | 2.2444 |
| Escanaba..... | 11,750 | 9,929 | 2,449 | 1,273 | 25,401 | .10 | 78 | 50 | 128 | .12 | 5 | .08 | 1 | 20 | .07 | .0862 |
| Flint..... | 100,733 | 87,362 | 12,491 | 5,988 | 206,574 | .78 | 283 | 367 | 670 | .84 | 40 | .68 | 8 | 203 | .69 | .6729 |
| Grand Rapids..... | 106,674 | 82,311 | 17,860 | 7,799 | 214,544 | .81 | 412 | 457 | 869 | .83 | 37 | .63 | 9 | 209 | .72 | .6366 |
| Jackson..... | 86,546 | 68,133 | 12,196 | 5,252 | 172,127 | .65 | 296 | 348 | 644 | .62 | 29 | .49 | 4 | 170 | .61 | .3956 |
| Kalamazoo..... | 85,195 | 41,334 | 8,915 | 3,684 | 109,128 | .41 | 204 | 221 | 425 | .41 | 22 | .37 | 4 | 118 | .40 | .2949 |
| Lansing..... | 42,614 | 32,440 | 5,890 | 2,533 | 83,477 | .31 | 163 | 184 | 347 | .33 | 13 | .22 | 2 | 41 | .14 | .2138 |
| Muskegon..... | 54,977 | 46,472 | 9,217 | 4,375 | 115,041 | .43 | 179 | 232 | 411 | .39 | 37 | .63 | 10 | 226 | .77 | .4256 |
| Saginaw..... | 78,964 | 61,990 | 11,071 | 5,375 | 155,300 | .58 | 240 | 294 | 534 | .50 | 27 | .46 | 10 | 170 | .60 | .3652 |
| OHIO | | | | | | | | | | | | | | | | |
| Akron..... | 104,627 | 90,739 | 13,971 | 7,543 | 216,880 | .82 | 339 | 420 | 759 | .73 | 52 | .88 | 10 | 210 | .72 | .6345 |
| Canton..... | 158,491 | 139,211 | 21,331 | 11,627 | 330,660 | 1.24 | 514 | 599 | 1,113 | 1.07 | 36 | .61 | 2 | 156 | .53 | 1.0026 |
| Cincinnati..... | 130,731 | 97,463 | 19,574 | 9,985 | 257,443 | .97 | 395 | 454 | 849 | .82 | 42 | .71 | 7 | 351 | 1.20 | .9098 |
| Cleveland..... | 246,449 | 239,799 | 31,649 | 18,093 | 535,180 | 2.01 | 620 | 1,151 | 1,771 | 1.70 | 132 | 2.25 | 12 | 553 | 1.89 | 1.9822 |
| Columbus..... | 189,672 | 131,649 | 25,473 | 12,235 | 369,229 | 1.35 | 577 | 603 | 1,180 | 1.13 | 76 | 1.29 | 5 | 323 | 1.11 | .8774 |
| Dayton..... | 124,741 | 87,339 | 16,527 | 7,962 | 236,569 | .89 | 372 | 461 | 833 | .80 | 55 | .94 | 8 | 230 | .79 | .6331 |
| E. Liverpool..... | 67,101 | 62,058 | 11,491 | 6,185 | 146,818 | .55 | 317 | 273 | 590 | .57 | 38 | .65 | 11 | 148 | .51 | .5231 |
| Lima..... | 73,070 | 60,597 | 8,737 | 4,173 | 136,577 | .51 | 293 | 321 | 614 | .59 | 34 | .56 | 6 | 78 | .27 | .2871 |
| Mansfield..... | 37,717 | 30,198 | 4,616 | 2,400 | 74,931 | .28 | 147 | 139 | 286 | .27 | 26 | .44 | 1 | 38 | .12 | .1829 |
| Portsmouth..... | 50,329 | 30,012 | 8,019 | 3,702 | 92,062 | .35 | 164 | 170 | 334 | .32 | 27 | .46 | 5 | 94 | .32 | .2455 |
| Springfield..... | 60,842 | 38,373 | 8,214 | 3,750 | 111,167 | .42 | 219 | 199 | 418 | .40 | 24 | .41 | 1 | 67 | .23 | .2416 |
| Staubenville..... | 27,427 | 24,466 | 4,062 | 2,264 | 58,279 | .22 | 121 | 88 | 207 | .20 | 10 | .17 | 4 | 47 | .16 | .1663 |
| *Toledo..... | 98,425 | 86,195 | 13,483 | 7,234 | 205,337 | .77 | 304 | 330 | 634 | .61 | 35 | .60 | 10 | 232 | .79 | .5264 |
| Youngstown..... | 55,296 | 47,209 | 7,543 | 4,092 | 114,140 | .43 | 188 | 192 | 380 | .37 | 27 | .46 | 7 | 104 | .36 | .3647 |
| WISCONSIN | | | | | | | | | | | | | | | | |
| *Eau Claire..... | 43,218 | 24,524 | 12,745 | 5,220 | 85,707 | .32 | 263 | 146 | 409 | .39 | 10 | .17 | 3 | 54 | .18 | .2108 |
| Green Bay..... | 113,716 | 88,450 | 29,150 | 14,513 | 245,829 | .92 | 649 | 471 | 1,120 | 1.08 | 50 | .85 | 5 | 200 | .68 | .7312 |
| La Crosse..... | 41,097 | 26,900 | 10,540 | 4,613 | 83,440 | .31 | 219 | 190 | 409 | .39 | 9 | .15 | 1 | 55 | .19 | .1856 |
| Madison..... | 69,757 | 47,564 | 17,684 | 8,306 | 143,311 | .54 | 410 | 250 | 670 | .64 | 35 | .60 | 1 | 103 | .35 | .3726 |
| Milwaukee..... | 124,913 | 112,778 | 24,026 | 13,046 | 274,763 | 1.03 | 450 | 609 | 1,059 | 1.02 | 49 | .83 | 9 | 404 | 1.38 | 1.1048 |
| Wausau..... | 30,168 | 22,423 | 11,537 | 5,013 | 77,141 | .29 | 197 | 148 | 345 | .33 | 13 | .22 | 1 | 42 | .14 | .2066 |

ZONE 5

Minnesota, Missouri, Iowa, North Dakota, South Dakota, Nebraska and Kansas

| | | | | | | | | | | | | | | | | | |
|---------------------------|---------|---------|--------|--------|---------|------|-------|-------|-------|------|-----|------|----|-----|------|--------|--|
| IOWA | | | | | | | | | | | | | | | | | |
| Burlington..... | 59,794 | 37,030 | 8,633 | 3,585 | 109,242 | .41 | 290 | 298 | 546 | .53 | 27 | .46 | 1 | 82 | .28 | .2810 | |
| Cedar Rapids..... | 51,590 | 36,246 | 8,447 | 3,530 | 100,172 | .38 | 242 | 224 | 476 | .46 | 19 | .32 | 5 | 63 | .18 | .2884 | |
| Davenport..... | 86,276 | 61,262 | 13,781 | 5,902 | 167,221 | .63 | 374 | 369 | 743 | .71 | 36 | .61 | 7 | 139 | .48 | .4726 | |
| Des Moines..... | 240,660 | 156,137 | 38,263 | 15,582 | 450,642 | 1.69 | 1,000 | 1,005 | 2,095 | 2.01 | 97 | 1.65 | 17 | 253 | .87 | 1.2397 | |
| Dubuque..... | 73,281 | 45,804 | 15,065 | 6,208 | 140,358 | .53 | 424 | 313 | 737 | .71 | 25 | .43 | 3 | 68 | .20 | .3349 | |
| Fort Dodge..... | 44,406 | 27,606 | 7,050 | 2,816 | 81,878 | .31 | 217 | 204 | 421 | .40 | 16 | .27 | 2 | 20 | .07 | .1654 | |
| Ottumwa..... | 47,365 | 24,969 | 6,258 | 2,319 | 80,901 | .30 | 189 | 226 | 415 | .40 | 10 | .17 | 1 | 16 | .05 | .1733 | |
| Sioux City..... | 53,002 | 33,035 | 8,130 | 3,220 | 97,387 | .37 | 283 | 230 | 493 | .47 | 18 | .31 | 3 | 73 | .25 | .2632 | |
| Waterloo..... | 79,044 | 55,317 | 12,638 | 4,945 | 152,144 | .57 | 370 | 357 | 727 | .70 | 26 | .44 | 7 | 73 | .25 | .3868 | |
| KANSAS | | | | | | | | | | | | | | | | | |
| Atchison..... | 33,331 | 20,550 | 5,486 | 2,333 | 61,700 | .23 | 123 | 164 | 287 | .28 | 12 | .20 | 1 | 23 | .08 | .1302 | |
| Hutchinson..... | 52,431 | 34,027 | 10,034 | 4,816 | 101,908 | .38 | 194 | 232 | 426 | .41 | 30 | .51 | 6 | 93 | .32 | .2591 | |
| Salina..... | 54,291 | 29,641 | 10,867 | 4,382 | 99,201 | .37 | 337 | 297 | 634 | .61 | 20 | .34 | 4 | 17 | .06 | .2047 | |
| Topeka..... | 38,410 | 25,617 | 6,034 | 2,752 | 72,813 | .27 | 125 | 189 | 314 | .30 | 19 | .32 | 1 | 63 | .22 | .1900 | |
| Wichita..... | 113,951 | 61,939 | 24,406 | 9,814 | 210,110 | .79 | 510 | 523 | 1,033 | .99 | 55 | .94 | 6 | 141 | .48 | .4802 | |
| MINNESOTA | | | | | | | | | | | | | | | | | |
| Albert Lea..... | 41,409 | 31,124 | 9,746 | 4,310 | 86,589 | .33 | 225 | 218 | 443 | .43 | 11 | .19 | 4 | 22 | .07 | .1816 | |
| Duluth..... | 36,485 | 35,256 | 10,715 | 6,872 | 89,329 | .34 | 246 | 216 | 462 | .44 | 14 | .24 | 0 | 103 | .35 | .3235 | |
| Minneapolis-St. Paul..... | 146,009 | 123,323 | 39,796 | 18,588 | 329,676 | 1.34 | 485 | 648 | 1,143 | 1.10 | 55 | .94 | 17 | 394 | 1.35 | 1.1797 | |
| MISSOURI | | | | | | | | | | | | | | | | | |
| Joplin..... | 64,306 | 36,614 | 12,468 | 4,955 | 119,373 | .45 | 242 | 352 | 594 | .57 | 39 | .66 | 3 | 71 | .24 | .3150 | |
| Kansas City..... | 191,667 | 117,645 | 34,976 | 14,621 | 358,909 | 1.35 | 534 | 962 | 1,516 | 1.46 | 102 | 1.74 | 8 | 436 | 1.49 | 1.2426 | |
| St. Joseph..... | 71,011 | 37,616 | 12,020 | 4,664 | 125,311 | .47 | 186 | 343 | 529 | .51 | 23 | .39 | 1 | 109 | .37 | .3319 | |
| St. Louis..... | 272,210 | 161,223 | 48,201 | 19,484 | 502,128 | 1.98 | 790 | 1,340 | 2,130 | 2.05 | 106 | 1.80 | 7 | 685 | 2.00 | 2.0426 | |
| Springfield..... | 47,191 | 17,962 | 8,331 | 2,632 | 78,116 | .29 | 164 | 234 | 398 | .38 | 14 | .24 | 3 | 45 | .15 | .1669 | |
| NEBRASKA | | | | | | | | | | | | | | | | | |
| Hastings..... | 34,698 | 17,903 | 5,731 | 2,326 | 60,658 | .23 | 163 | 217 | 380 | .37 | 20 | .34 | 2 | 19 | .06 | .1262 | |
| Lincoln..... | 85,891 | 53,973 | 15,723 | 6,918 | 162,506 | .61 | 300 | 465 | 765 | .73 | 49 | .83 | 17 | 219 | .75 | .4714 | |
| Norfolk..... | 44,032 | 17,959 | 7,161 | 2,400 | 71,572 | .27 | 247 | 181 | 428 | .41 | 7 | .12 | 1 | 10 | .03 | .1412 | |
| Omaha..... | 104,905 | 62,163 | 17,708 | 7,790 | 192,566 | .72 | 375 | 502 | 877 | .84 | 49 | .83 | 18 | 225 | .78 | .5569 | |

ZONE 5—Continued Minnesota, Missouri, Iowa, North Dakota, South Dakota, Nebraska and Kansas

| STATE | REGISTRATIONS December 31, 1935 | | | | | Percentage of Total U. S. Motor Vehicle Registrations | RETAIL TRADE ESTABLISHMENTS July, 1936 | | | | WHOLE- SALEERS July, 1936 | | Car and Truck Dist. and Branches—July, 1936 | FLEETS July, 1936 | | Percentage of Total U. S. Spendable Money Income 1935 |
|------------------|------------------------------------|---------------|--------------------------|---------------|----------------------------|----------------------------------------------------------|----------------------------------------------|------------------------------------------------|--------------------|-----------------------------------------------------------|---------------------------------|--------------------------------------------------------|------------------------------------------------|------------------------------|-------------------------------------------|-------------------------------------------------------------|
| | Passenger Cars | | Trucks | | Total Motor Vehicles | | Car and Truck Dealers | Garages, Repair Shops and Access. Stores | Total Retail Units | Percentage of Total U. S. Automotive Retail Outlets | All Wholesalers | Percentage of Total U. S. Automotive Wholesalers | | Fleets—5 or More Vehicles | Percentage of Total U. S. Fleet Owners | |
| | Ford and Chevrolet | All Others | Ford and Chevrolet | All Others | | | | | | | | | | | | |
| NORTH DAKOTA | | | | | | | | | | | | | | | | |
| Bismarck..... | 22,780 | 12,347 | 5,680 | 2,202 | 43,009 | .16 | 190 | 130 | 320 | .31 | 8 | .14 | 2 | 10 | .03 | .0934 |
| Fargo..... | 46,526 | 30,630 | 10,547 | 4,547 | 92,250 | .35 | 286 | 259 | 545 | .52 | 17 | .29 | 4 | 31 | .11 | .2088 |
| Grand Forks..... | 27,615 | 17,860 | 8,236 | 2,657 | 54,368 | .20 | 205 | 156 | 361 | .35 | 8 | .14 | 2 | 14 | .05 | .1189 |
| Minot..... | 19,289 | 9,100 | 4,937 | 1,853 | 35,179 | .13 | 114 | 108 | 222 | .21 | 5 | .08 | 4 | 9 | .03 | .0750 |
| SOUTH DAKOTA | | | | | | | | | | | | | | | | |
| Sioux Falls..... | 43,303 | 31,057 | 7,823 | 3,475 | 85,658 | .32 | 261 | 208 | 469 | .45 | 9 | .15 | 4 | 31 | .11 | .1799 |

ZONE 6**Kentucky, Tennessee, Alabama and Mississippi**

| | | | | | | | | | | | | | | | | |
|--------------------|--------|--------|--------|-------|---------|-----|-----|-----|-----|-----|----|-----|---|-----|-----|-------|
| ALABAMA | | | | | | | | | | | | | | | | |
| Birmingham..... | 61,980 | 40,315 | 17,414 | 5,752 | 145,461 | .55 | 172 | 288 | 458 | .44 | 37 | .63 | 4 | 136 | .47 | .5225 |
| Mobile..... | 35,312 | 18,411 | 10,630 | 3,459 | 67,812 | .25 | 102 | 161 | 263 | .25 | 26 | .44 | 3 | 75 | .26 | .2516 |
| Montgomery..... | 20,535 | 9,242 | 4,217 | 1,354 | 35,348 | .13 | 54 | 93 | 147 | .14 | 11 | .19 | 3 | 44 | .15 | .1316 |
| KENTUCKY | | | | | | | | | | | | | | | | |
| Lexington..... | 44,078 | 25,192 | 7,095 | 2,940 | 79,305 | .30 | 177 | 153 | 330 | .32 | 15 | .26 | 6 | 53 | .18 | .1771 |
| Louisville..... | 76,700 | 47,553 | 13,896 | 5,406 | 143,555 | .54 | 188 | 290 | 478 | .46 | 32 | .54 | 7 | 186 | .64 | .5276 |
| Paducah..... | 24,140 | 10,338 | 3,382 | 1,133 | 38,993 | .15 | 88 | 67 | 145 | .14 | 9 | .15 | 1 | 22 | .07 | .1049 |
| MISSISSIPPI | | | | | | | | | | | | | | | | |
| Jackson..... | 33,518 | 12,540 | 7,611 | 2,184 | 55,853 | .21 | 110 | 113 | 223 | .21 | 11 | .19 | 1 | 28 | .10 | .2011 |
| Meridian..... | 20,330 | 6,697 | 4,304 | 1,177 | 32,508 | .12 | 79 | 101 | 180 | .17 | 5 | .08 | 2 | 9 | .03 | .1100 |
| TENNESSEE | | | | | | | | | | | | | | | | |
| Chattanooga..... | 55,542 | 27,298 | 10,850 | 3,835 | 97,525 | .37 | 145 | 180 | 325 | .31 | 23 | .39 | 4 | 84 | .29 | .3248 |
| Knoxville..... | 76,204 | 37,889 | 13,356 | 5,243 | 132,692 | .50 | 227 | 245 | 338 | .32 | 30 | .51 | 4 | 81 | .28 | .3791 |
| Memphis..... | 13,574 | 50,851 | 22,273 | 7,188 | 212,186 | .80 | 368 | 349 | 717 | .69 | 41 | .70 | 5 | 177 | .61 | .7603 |
| Nashville..... | 75,147 | 32,394 | 11,480 | 4,155 | 123,176 | .46 | 144 | 237 | 381 | .37 | 24 | .41 | 5 | 101 | .35 | .4015 |

ZONE 7**Arkansas, Louisiana, Oklahoma and Texas**

| | | | | | | | | | | | | | | | | |
|--------------------|---------|--------|--------|--------|---------|------|-----|-----|-------|------|-----|------|----|-----|-----|--------|
| ARKANSAS | | | | | | | | | | | | | | | | |
| Fort Smith..... | 26,461 | 11,102 | 5,551 | 1,783 | 44,917 | .17 | 86 | 131 | 217 | .21 | 13 | .22 | .. | 35 | .12 | .1501 |
| Little Rock..... | 147,644 | 72,600 | 25,561 | 9,883 | 255,688 | .96 | 83 | 67 | 150 | .14 | 8 | .14 | .. | 15 | .05 | .1272 |
| LOUISIANA | | | | | | | | | | | | | | | | |
| Alexandria..... | 17,729 | 4,369 | 5,222 | 1,299 | 28,618 | .11 | 40 | 65 | 105 | .10 | 5 | .08 | .. | 13 | .04 | .0777 |
| Baton Rouge..... | 37,060 | 12,397 | 11,137 | 3,333 | 63,927 | .24 | 120 | 135 | 255 | .24 | 16 | .27 | .. | 65 | .22 | .1838 |
| Monroe..... | 42,363 | 13,080 | 10,427 | 2,934 | 68,814 | .26 | 115 | 111 | 226 | .22 | 10 | .17 | .. | 49 | .17 | .1960 |
| New Orleans..... | 88,800 | 38,671 | 28,855 | 10,717 | 167,243 | .63 | 223 | 389 | 612 | .55 | 48 | .82 | .. | 277 | .95 | .6741 |
| Shreveport..... | 104,922 | 35,702 | 21,703 | 6,420 | 168,747 | .63 | 213 | 273 | 486 | .47 | 40 | .68 | 3 | 99 | .34 | .4160 |
| OKLAHOMA | | | | | | | | | | | | | | | | |
| Ada..... | 35,576 | 12,647 | 6,990 | 2,253 | 57,466 | .22 | 94 | 107 | 201 | .19 | 13 | .22 | .. | 8 | .03 | .1646 |
| Enid..... | 25,693 | 9,369 | 5,843 | 2,134 | 43,039 | .16 | 103 | 91 | 194 | .19 | 4 | .07 | 1 | 21 | .07 | .0867 |
| Oklahoma City..... | 241,949 | 99,197 | 54,266 | 18,584 | 413,996 | 1.56 | 746 | 768 | 1,514 | 1.45 | 108 | 1.84 | 12 | 220 | .75 | 1.0711 |
| Shawnee..... | 44,801 | 16,806 | 8,030 | 2,723 | 72,360 | .27 | 125 | 150 | 275 | .26 | 18 | .31 | .. | 17 | .06 | .2135 |
| Tulsa..... | 85,107 | 49,330 | 19,349 | 7,937 | 161,723 | .61 | 206 | 338 | 546 | .52 | 46 | .78 | 6 | 155 | .53 | .4900 |
| TEXAS | | | | | | | | | | | | | | | | |
| Amarillo..... | 51,300 | 21,114 | 13,636 | 4,597 | 90,647 | .34 | 210 | 222 | 432 | .41 | 29 | .48 | 4 | 28 | .10 | .2200 |
| Austin..... | 94,835 | 35,597 | 19,783 | 6,108 | 155,301 | .58 | 285 | 397 | 682 | .64 | 17 | .29 | 1 | 40 | .14 | .3484 |
| Beaumont..... | 53,016 | 21,437 | 11,861 | 3,775 | 90,089 | .34 | 125 | 221 | 346 | .33 | 14 | .24 | 2 | 55 | .19 | .2461 |
| Dallas..... | 228,975 | 90,752 | 37,556 | 11,961 | 369,244 | 1.39 | 459 | 761 | 1,220 | 1.17 | 71 | 1.21 | 8 | 191 | .65 | 1.0254 |
| El Paso..... | 28,979 | 17,369 | 7,918 | 3,057 | 57,323 | .22 | 85 | 85 | 170 | .16 | 17 | .29 | 4 | 53 | .18 | .1471 |
| Fort Worth..... | 68,325 | 30,602 | 11,706 | 4,189 | 114,822 | .43 | 150 | 310 | 460 | .44 | 21 | .36 | 5 | 102 | .35 | .3180 |
| Harlingen..... | 20,000 | 8,076 | 6,271 | 2,075 | 36,422 | .14 | 48 | 91 | 139 | .13 | 7 | .12 | 2 | 15 | .05 | .0897 |
| Houston..... | 154,117 | 72,584 | 31,101 | 10,525 | 268,327 | 1.01 | 326 | 494 | 820 | .79 | 44 | .75 | 10 | 216 | .74 | .8017 |
| Lubbock..... | 29,366 | 11,919 | 6,446 | 2,112 | 40,843 | .19 | 99 | 105 | 204 | .20 | 10 | .17 | .. | 5 | .02 | .1167 |
| San Antonio..... | 154,922 | 68,278 | 37,023 | 12,781 | 273,004 | 1.03 | 365 | 642 | 1,007 | .97 | 42 | .71 | 6 | 138 | .47 | .7216 |
| Waco..... | 124,671 | 43,819 | 21,642 | 6,852 | 197,184 | .74 | 350 | 501 | 851 | .82 | 37 | .63 | 2 | 64 | .22 | .4951 |
| Wichita Falls..... | 49,959 | 23,924 | 9,308 | 3,637 | 86,828 | .33 | 113 | 183 | 296 | .28 | 19 | .32 | 4 | 73 | .25 | .2459 |

ZONE 8**Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah and Nevada**

| | | | | | | | | | | | | | | | | |
|---------------------|---------|---------|--------|--------|---------|------|-----|-----|-------|------|----|------|----|-----|------|--------|
| ARIZONA | | | | | | | | | | | | | | | | |
| Phoenix..... | 42,908 | 42,645 | 12,672 | 6,998 | 105,221 | .40 | 133 | 191 | 324 | .31 | 24 | .41 | 5 | 101 | .35 | .2570 |
| Tucson..... | 15,316 | 16,309 | 4,056 | 2,286 | 37,947 | .14 | 54 | 61 | 115 | .11 | 9 | .15 | 2 | 34 | .12 | .0909 |
| COLORADO | | | | | | | | | | | | | | | | |
| Denver..... | 201,782 | 153,298 | 37,906 | 16,959 | 409,945 | 1.54 | 855 | 907 | 1,762 | 1.69 | 91 | 1.55 | 17 | 364 | 1.25 | 1.0577 |
| Grand Junction..... | 11,612 | 11,007 | 1,956 | 1,049 | 25,624 | .10 | 79 | 42 | 121 | .12 | 6 | .10 | .. | 10 | .03 | .0636 |
| Pueblo..... | 95,249 | 69,959 | 21,008 | 9,074 | 196,290 | .74 | 397 | 347 | 744 | .71 | 47 | .80 | 5 | 120 | .41 | .4704 |
| Sterling..... | 22,709 | 10,974 | 5,142 | 1,931 | 40,756 | .15 | 108 | 97 | 205 | .20 | 6 | .10 | .. | 9 | .03 | .0658 |
| IDAHO | | | | | | | | | | | | | | | | |
| Boise..... | 27,679 | 21,585 | 6,240 | 3,090 | 58,774 | .22 | 125 | 115 | 240 | .23 | 17 | .29 | 5 | 24 | .08 | .1385 |
| Lewiston..... | 15,756 | 15,884 | 4,156 | 2,474 | 38,250 | .14 | 120 | 102 | 222 | .21 | 8 | .14 | .. | 11 | .04 | .0905 |

ZONE 8—Continued Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah and Nevada

| STATE | REGISTRATIONS December 31, 1935 | | | | | Percentage of Total U. S. Motor Vehicle Registrations | RETAIL TRADE ESTABLISHMENTS July, 1936 | | | | WHOLE- SALEERS July, 1936 | | Car and Truck Dist. and Branches—July, 1936 | FLEETS July, 1936 | | Percentage of Total U. S. Spendable Money Income 1935 |
|---------------------|------------------------------------|---------------|--------------------------|---------------|----------------------------|----------------------------------------------------------|----------------------------------------------|-----------------------------------------------|--------------------|-----------------------------------------------------------|---------------------------------|--------------------------------------------------------|------------------------------------------------|------------------------------|-------------------------------------------|-------------------------------------------------------------|
| | Passenger Cars | | Trucks | | Total Motor Vehicles | | Car and Truck Dealers | Garages, Repair Shops and Acces- sories | Total Retail Units | Percentage of Total U. S. Automotive Retail Outlets | All Wholesalers | Percentage of Total U. S. Automotive Wholesalers | | Fleets—5 or More Vehicles | Percentage of Total U. S. Fleet Owners | |
| | Ford and Chevrolet | All Others | Ford and Chevrolet | All Others | | | | | | | | | | | | |
| MONTANA | | | | | | | | | | | | | | | | |
| Billings..... | 17,575 | 15,909 | 6,322 | 3,323 | 43,129 | .16 | 113 | 123 | 236 | .23 | 11 | .19 | 7 | 23 | .06 | .0935 |
| Butte..... | 14,545 | 14,909 | 4,782 | 2,713 | 36,949 | .14 | 87 | 94 | 181 | .17 | 10 | .17 | 4 | 46 | .16 | .1122 |
| Great Falls..... | 20,766 | 13,228 | 7,609 | 3,477 | 45,080 | .17 | 141 | 114 | 255 | .34 | 11 | .19 | 3 | 37 | .13 | .1182 |
| Helena..... | 7,739 | 9,142 | 2,206 | 1,503 | 20,589 | .08 | 37 | 48 | 85 | .06 | 9 | .16 | 4 | 40 | .14 | .0732 |
| NEVADA | | | | | | | | | | | | | | | | |
| Reno..... | 33,024 | 32,894 | 7,544 | 4,512 | 77,974 | .28 | 243 | 240 | 483 | .46 | 17 | .29 | 5 | 57 | .19 | .1795 |
| NEW MEXICO | | | | | | | | | | | | | | | | |
| Albuquerque..... | 44,371 | 29,970 | 13,815 | 5,997 | 93,853 | .35 | 163 | 149 | 312 | .30 | 23 | .39 | 3 | 42 | .14 | .1999 |
| UTAH | | | | | | | | | | | | | | | | |
| Odgen..... | 125,419 | 112,134 | 33,214 | 18,298 | 289,065 | 1.09 | 657 | 623 | 1,280 | 1.23 | 67 | 1.14 | 17 | 244 | .84 | .7634 |
| Salt Lake City..... | 125,419 | 112,134 | 34,214 | 18,298 | 289,065 | 1.09 | 657 | 623 | 1,280 | 1.23 | 67 | 1.14 | 17 | 244 | .84 | .7634 |
| WYOMING | | | | | | | | | | | | | | | | |
| Casper..... | 52,174 | 36,432 | 16,390 | 7,585 | 114,581 | .43 | 324 | 287 | 611 | .59 | 23 | .39 | 10 | 75 | .26 | .2520 |

ZONE 9

Washington, Oregon and California

| | | | | | | | | | | | | | | | | |
|--------------------|---------|---------|--------|--------|-----------|------|-----|-------|-------|------|-----|------|----|-----|------|--------|
| CALIFORNIA | | | | | | | | | | | | | | | | |
| Fresno..... | 52,322 | 53,466 | 10,507 | 4,744 | 121,039 | .46 | 176 | 247 | 423 | .41 | 27 | .46 | 3 | 97 | .33 | .3007 |
| Los Angeles..... | 456,015 | 556,360 | 56,227 | 36,966 | 1,106,577 | 4.17 | 746 | 3,161 | 3,909 | 3.76 | 239 | 4.07 | 20 | 917 | 3.14 | 3.2930 |
| Oakland..... | 102,335 | 157,609 | 14,694 | 10,850 | 285,588 | 1.07 | 248 | 691 | 939 | .80 | 61 | 1.04 | 3 | 266 | .91 | .8623 |
| Sacramento..... | 54,001 | 65,325 | 12,018 | 7,046 | 136,390 | .52 | 211 | 355 | 566 | .54 | 27 | .46 | 4 | 118 | .40 | .3314 |
| San Diego..... | 46,790 | 54,524 | 6,337 | 6,308 | 111,259 | .42 | 99 | 404 | 503 | .48 | 25 | .43 | 6 | 89 | .26 | .3201 |
| San Francisco..... | 226,969 | 325,166 | 38,614 | 26,559 | 619,308 | 2.33 | 573 | 1,531 | 2,104 | 2.02 | 150 | 2.55 | 14 | 687 | 2.35 | 2.1576 |
| San Jose..... | 41,233 | 62,806 | 7,806 | 5,240 | 107,067 | .40 | 129 | 253 | 382 | .37 | 21 | .36 | 1 | 69 | .30 | .3563 |
| Santa Ana..... | 18,080 | 25,067 | 3,025 | 2,103 | 48,295 | .18 | 60 | 176 | 236 | .23 | 13 | .22 | 1 | 40 | .14 | .0977 |
| Stockton..... | 20,757 | 24,686 | 4,170 | 2,910 | 52,523 | .20 | 80 | 130 | 190 | .18 | 9 | .15 | 1 | 45 | .15 | .1251 |
| OREGON | | | | | | | | | | | | | | | | |
| Portland..... | 155,947 | 145,742 | 22,287 | 10,517 | 334,493 | 1.26 | 503 | 1,047 | 1,550 | 1.49 | 91 | 1.55 | 11 | 251 | .86 | .9245 |
| WASHINGTON | | | | | | | | | | | | | | | | |
| Bellingham..... | 13,974 | 11,235 | 2,980 | 1,545 | 29,734 | .11 | 57 | 98 | 155 | .15 | 8 | .14 | .. | 25 | .09 | .0792 |
| Seattle..... | 297,171 | 181,596 | 46,242 | 25,745 | 470,754 | 1.77 | 729 | 1,543 | 2,272 | 2.18 | 134 | 2.28 | 19 | 485 | 1.66 | 1.4280 |
| Spokane..... | 46,275 | 46,133 | 11,738 | 6,778 | 112,924 | .42 | 278 | 305 | 583 | .56 | 25 | .42 | 7 | 95 | .33 | .3120 |
| Tacoma..... | 36,388 | 33,224 | 8,742 | 4,815 | 83,179 | .31 | 100 | 292 | 392 | .38 | 25 | .42 | 2 | 80 | .27 | .2242 |

Automotive Wholesale Business \$2,155,170,000 in 1935

NET Automotive Wholesale Sales in the United States during 1935 amounted to \$2,155,170,000, according to the Business Census of Wholesale Distribution recently released by the Bureau of the Census. These sales include, (a) automobiles and other motor vehicles, (b) automotive equipment (including accessories and parts), (c) tires and tubes.

These wholesalers are divided into several classifications, i.e.: Full-Service and Limited-Function Wholesalers, Manufacturers' Sales Branches with Stocks, Manufacturers' Sales Branches without Stocks, Agents and Brokers. For the purpose of this study, only the report of the Full-Service and Limited-Function Wholesaler will be analyzed. This type of wholesaler is defined by the Census Bureau as one engaged in

the buying and selling of goods on his own account and is largely independent in ownership. He includes such groups as wholesale merchants, voluntary-group wholesalers, industrial distributors, mail-order wholesalers and wagon distributors.

The net sales of the Full-Service and Limited-Function Wholesalers for 1935 amounted to \$777,829,000, an increase of 78 per cent over 1933 and comprises 36 per cent of all automotive wholesale sales. If the sales of Manufacturers' Sales Branches with Stocks are deducted, as in the automotive division, these include principally the sales of automobiles and other motor vehicles, then what is generally known as the legitimate automotive jobber does 86 per cent of the automotive wholesale business.

In the tabulation shown on the next page, we have attempted to present by zones and by States a detailed analysis of the reports for individual States as released by the Census Bureau.

These data will differ slightly from the United States Summary of Wholesale Distribution due to the revisions and additions that have been made since the release of the preliminary State reports. In detail are shown the number of establishments, net sales of the Full-Service Wholesaler, operating expenses, stocks on hand (at end of the year) and each State's portion of the total volume expressed in per cent of total. There is also indicated the ratio of inventory to net sales.

In order to clarify the meaning of these various classifications it might

Census of Automotive Wholesale 1935 Distribution *

| | Number of Establishments | Per cent of U. S. Total | Net Automotive Sales (000—omitted) | Per cent of U. S. Total | Operating Expenses (Including Payrolls) (000—omitted) | Per cent of U. S. Total | Stocks on hand, end of year (000—omitted) | Per cent of U. S. Total | Ratio of Inventory to Net Sales (to 1) |
|-------------------------|--------------------------|-------------------------|------------------------------------|-------------------------|-------------------------------------------------------|-------------------------|-------------------------------------------|-------------------------|----------------------------------------|
| Connecticut..... | 67 | 1.19 | \$ 8,513 | 1.09 | \$ 1,427 | 1.08 | \$ 1,173 | 1.09 | 7 |
| Maine..... | 25 | .44 | 2,334 | .31 | 582 | .44 | 445 | .41 | 5 |
| Massachusetts..... | 171 | 3.03 | 37,781 | 4.86 | 5,030 | 3.82 | 4,057 | 3.78 | 9 |
| New Hampshire..... | 14 | .25 | 1,112 | .14 | 202 | .15 | 181 | .17 | 6 |
| Rhode Island..... | 26 | .46 | 1,971 | .25 | 519 | .39 | 449 | .42 | 4 |
| Vermont..... | 12 | .21 | 1,105 | .14 | 263 | .21 | 248 | .23 | 5 |
| Total..... | 315 | 5.58 | \$ 52,816 | 6.79 | \$ 8,023 | 6.09 | \$ 6,553 | 6.10 | 8 |
| New Jersey..... | 126 | 2.27 | 25,695 | 3.30 | 3,150 | 2.39 | 4,137 | 4.02 | 6 |
| New York..... | 519 | 9.18 | 105,825 | 13.61 | 18,582 | 14.11 | 11,582 | 10.78 | 9 |
| Pennsylvania..... | 347 | 6.14 | 50,962 | 6.55 | 8,988 | 6.83 | 8,034 | 7.48 | 6 |
| Total..... | 994 | 17.59 | \$182,482 | 23.46 | \$ 30,720 | 23.33 | \$ 23,943 | 22.28 | 8 |
| Illinois..... | 433 | 7.66 | 54,584 | 7.02 | 9,810 | 7.45 | 7,314 | 6.81 | 7 |
| Indiana..... | 160 | 2.83 | 25,671 | 3.30 | 3,479 | 2.64 | 2,639 | 2.46 | 5 |
| Michigan..... | 287 | 5.08 | 52,680 | 6.77 | 7,953 | 6.04 | 5,531 | 5.15 | 10 |
| Ohio..... | 402 | 7.11 | 54,372 | 6.99 | 8,052 | 6.11 | 6,189 | 5.76 | 9 |
| Wisconsin..... | 131 | 2.32 | 11,227 | 1.44 | 2,520 | 1.92 | 2,068 | 1.91 | 5 |
| Total..... | 1,413 | 25.00 | \$198,534 | 25.52 | \$ 31,814 | 24.16 | \$ 23,741 | 22.09 | 8 |
| Iowa..... | 137 | 2.43 | 15,536 | 2.00 | 2,630 | 1.99 | 2,305 | 2.14 | 7 |
| Kansas..... | 99 | 1.75 | 9,124 | 1.04 | 1,473 | 1.12 | 1,405 | 1.31 | 6 |
| Minnesota..... | 134 | 2.37 | 25,259 | 3.25 | 4,040 | 3.06 | 3,556 | 3.31 | 6 |
| Missouri..... | 220 | 3.90 | 22,735 | 2.92 | 4,525 | 3.43 | 3,556 | 3.31 | 6 |
| Nebraska..... | 72 | 1.27 | 10,672 | 1.37 | 1,884 | 1.42 | 1,781 | 1.66 | 6 |
| North Dakota..... | 39 | .69 | 5,020 | .65 | 952 | .73 | 976 | .91 | 5 |
| South Dakota..... | 46 | .81 | 4,950 | .64 | 852 | .65 | 1,047 | .97 | 5 |
| Total..... | 747 | 13.22 | \$ 92,296 | 11.87 | \$ 16,336 | 12.40 | \$ 14,626 | 13.61 | 6 |
| Delaware..... | 5 | .09 | 745 | .10 | 204 | .15 | 197 | .18 | 4 |
| Dist. of Columbia..... | 30 | .53 | 9,337 | 1.20 | 1,148 | .87 | 696 | .65 | 13 |
| Florida..... | 79 | 1.40 | 6,464 | .83 | 1,237 | .94 | 971 | .90 | 7 |
| Georgia..... | 64 | 1.13 | 10,618 | 1.39 | 2,010 | 1.53 | 1,211 | 1.13 | 9 |
| Maryland..... | 65 | 1.06 | 3,600 | .46 | 952 | .72 | 727 | .69 | 5 |
| North Carolina..... | 90 | 1.68 | 10,649 | 1.37 | 1,810 | 1.37 | 1,537 | 1.43 | 7 |
| South Carolina..... | 28 | .50 | 2,665 | .34 | 522 | .41 | 362 | .34 | 7 |
| Virginia..... | 50 | .88 | 5,797 | .75 | 1,211 | .92 | 1,151 | 1.07 | 5 |
| West Virginia..... | 66 | 1.17 | 4,905 | .63 | 991 | .75 | 799 | .74 | 6 |
| Total..... | 477 | 8.44 | \$ 54,980 | 7.07 | \$ 10,085 | 7.66 | \$ 7,651 | 7.12 | 7 |
| Alabama..... | 35 | .62 | 2,790 | .36 | 605 | .46 | 545 | .51 | 5 |
| Kentucky..... | 71 | 1.25 | 4,022 | .52 | 897 | .68 | 704 | .65 | 6 |
| Mississippi..... | 28 | .50 | 2,204 | .28 | 506 | .38 | 393 | .37 | 6 |
| Tennessee..... | 67 | 1.19 | 7,167 | .92 | 1,504 | 1.15 | 1,206 | 1.12 | 6 |
| Total..... | 201 | 3.56 | \$ 16,203 | 2.08 | \$ 3,512 | 2.67 | \$ 2,848 | 2.65 | 6 |
| Arkansas..... | 37 | .65 | 1,979 | .25 | 582 | .45 | 536 | .50 | 4 |
| Louisiana..... | 48 | .85 | 6,744 | .87 | 1,451 | 1.10 | 1,395 | 1.30 | 5 |
| Oklahoma..... | 115 | 2.04 | 7,994 | 1.03 | 1,705 | 1.29 | 1,571 | 1.46 | 5 |
| Texas..... | 254 | 4.49 | 32,054 | 4.12 | 5,448 | 4.14 | 5,030 | 4.68 | 6 |
| Total..... | 454 | 8.03 | \$ 48,771 | 6.27 | \$ 9,186 | 6.98 | \$ 8,532 | 7.94 | 6 |
| Arizona..... | 28 | .50 | 3,676 | .47 | 671 | .51 | 705 | .66 | 5 |
| Colorado..... | 73 | 1.29 | 6,665 | .86 | 1,389 | 1.05 | 1,077 | 1.00 | 6 |
| Idaho..... | 21 | .37 | 1,242 | .16 | 272 | .21 | 317 | .29 | 4 |
| Montana..... | 24 | .42 | 3,927 | .51 | 600 | .46 | 657 | .61 | 6 |
| Nevada..... | 4 | .07 | 258 | .03 | 60 | .05 | 43 | .04 | 6 |
| New Mexico..... | 18 | .32 | 1,255 | .16 | 170 | .13 | 300 | .30 | 4 |
| Utah..... | 42 | .74 | 5,889 | .75 | 967 | .73 | 620 | .57 | 10 |
| Wyoming..... | 11 | .20 | 1,071 | .14 | 251 | .19 | 231 | .21 | 5 |
| Total..... | 221 | 3.91 | \$ 23,963 | 3.08 | \$ 4,380 | 3.33 | \$ 3,950 | 3.68 | 6 |
| California..... | 608 | 10.76 | 84,864 | 10.91 | 13,202 | 10.02 | 11,606 | 10.81 | 7 |
| Oregon..... | 84 | 1.49 | 10,610 | 1.37 | 1,701 | 1.29 | 1,733 | 1.61 | 6 |
| Washington..... | 137 | 2.42 | 12,310 | 1.58 | 2,732 | 2.07 | 2,271 | 2.11 | 5 |
| Total..... | 829 | 14.67 | \$107,784 | 13.86 | \$ 17,635 | 13.38 | \$ 15,610 | 14.53 | 7 |
| U. S. Total..... | 5,651 | 100.00 | \$777,823 | 100.00 | \$131,691 | 100.00 | \$107,454 | 100.00 | 7 |

* Census of Business, Bureau of the Census.

be well to give a few of the definitions:

Net Sales—Total net receipts of wholesale establishments, derived by deducting from gross sales the value of goods returned by, or allowances made to customers. Net sales also include operating receipts from services or other incidental income as well as receipts from the sale of merchandise.

Operating Expenses—All expenses

of reporting establishments. The amount does not include charges to capital account, cost of goods sold, income taxes, etc. In the case of unincorporated businesses, no compensation is included for the services of proprietors or firm members.

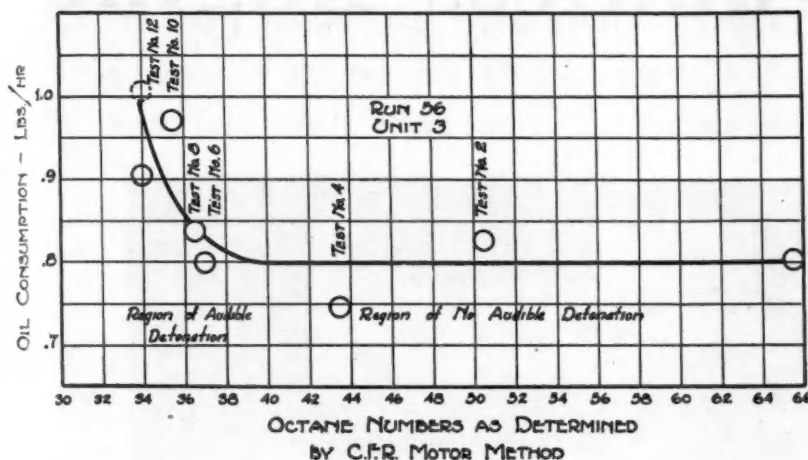
Stocks on Hand—The inventory value (at cost) of all merchandise on hand for resale at the end of the year

1935. The amount includes goods held on consignment as well as goods owned.

California leads in the total number of establishments, followed by New York, Illinois, Ohio and Pennsylvania in the order named. Despite the lead of California in number of establishments, New York led as to volume of business done with net sales of \$105,825,000, as

(Turn to page 868, please)

Effects of Detonation on Oil Consumption



Showing effect of detonation on engine oil consumption.

TESTS to determine the effect of detonation on oil consumption of engines have been made at The Pennsylvania State College as part of a research project carried out in conjunction with the Pennsylvania Crude Oil Association. This particular part of the project was dealt with in a paper recently read before the Baltimore Section of the S.A.E., by H. A. Everett, head of the Department of Mechanical Engineering, and J. J. Mikita, research assistant.

Detonation was induced in two ways, by advancing the spark and by adding a knock-inducing agent (amyl nitrite) to the fuel. The tests were made on six-cylinder engines of 3½-in. bore by 4½-in. stroke which with a compression ratio of 5.5 develop 75 hp. at 3600 r.p.m. In the first series, in which detonation was caused by advancing the spark beyond the normal setting, each series of runs was intended to extend over 15 hours, to be made up of individual runs of 2½-hrs. running, with intervals of 15 minutes between succeeding tests during which the engine was changed over to the new operating conditions.

In one test, increasing the spark advance from the normal of 28 deg. to 37 deg., where detonation set in, increased the oil consumption approximately 25 per cent. When the spark was returned to 28 deg. advance the detonation apparently ceased; but the rate of oil consumption, instead of decreasing, actually increased. Increasing the spark advance to 37 deg. once more caused audible detonation but no increase in the oil consumption. After

a 24-hr. shut-down and with the original spark setting the oil consumption returned to normal. The unexpected result was the "hangover" effect on the oil consumption when the spark was retarded after the engine had been knocking for some time, which effect was confirmed in some later runs.

With another test unit, when the spark was advanced to cause detonation, the oil consumption increased 23 per cent. With a third unit it was necessary to advance the spark to 45 deg. B.T.C. before there was any audi-

ble knock, and in this case the increase in oil consumption amounted to 20 per cent. This unit did not show the "hangover" effect noted in the foregoing when the spark was retarded after detonation.

In the second series of tests the spark advance was held constant at 35 deg. and fuels of decreasing octane value were used successively. Octane ratings were determined by two methods, viz., by a Series 30A Ethyl knock-testing engine (600 r.p.m., 212 deg. F. jacket temperature) and by a C.F.R. engine (C.F.R. motor method, 900 r.p.m., 212 deg. jacket temperature, 300 deg. F. intake temperature). These two methods gave rather different values for the octane number and in evaluating the results of this series of tests, fuel consumptions were plotted against octane numbers according to both methods of determination. One of the curves is reproduced herewith.

From the results of these tests it is concluded that oil consumption increases with detonation whether the latter is induced by increasing the spark advance or by the use of low-octane fuels; that the oil consumption increases with the severity of the detonation, and that the effect of detonation on oil consumption does not always vanish immediately with the cessation of audible detonation.

Two Books of Automotive Interest

Ingenious Mechanisms for Designers and Inventors. Vol. II. Edited by Franklin D. Jones. Associate Editor of Machinery. Published by The Industrial Press, New York.

THIS volume contains illustrated descriptions of numerous mechanisms and mechanical movements. Among the subjects dealt with, are cam applications and cam designs, intermittent motions (from gears and cams, from ratchet gearing, and of the Geneva type), tripping or stop mechanisms, overload relief mechanisms, drives of the crank type for reciprocating driven members, reciprocating motions from cams, gears and levers, speed-changing mechanisms, special transmissions and over-running clutches, centering mechanisms, multiple-lever mechanisms, feeding mechanisms, miscellaneous movements and valve diagrams. No automotive mechanisms are dealt with in the book which should

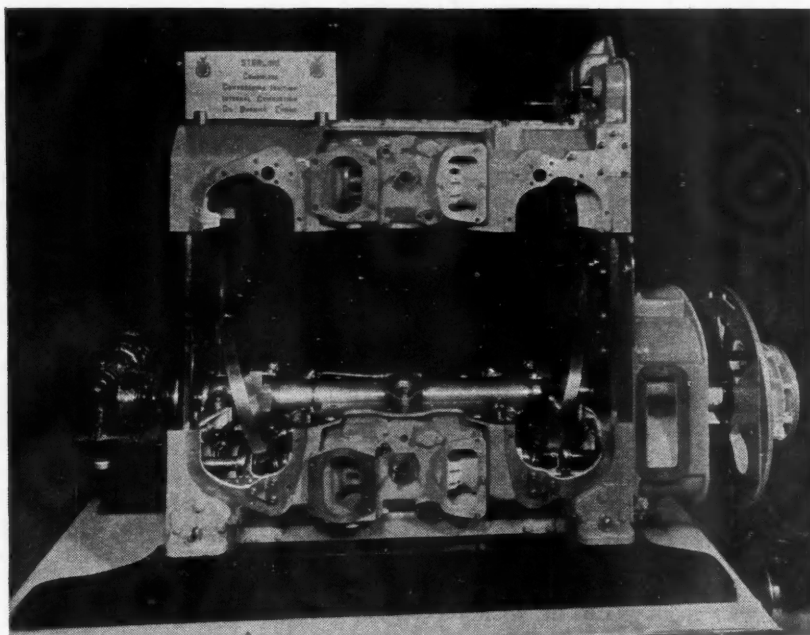
prove useful, however, to designers of tools, production equipment, and general machinery.

Machine Designers' Guide (Formulas, Mechanics, Graphics, Strength of Materials), by K. W. Najder. Second Edition. Published by Edwards Brothers, Inc., Ann Arbor, Mich.

THIS book contains a good deal of fundamental engineering information such as found in engineering handbooks, together with numerous worked-out examples. There are five sections. Section I contains mathematical tables and instructions for the construction of curves used in engineering work; Section II deals with mechanics, Section III with graphics, Section IV with strength of materials and Section V is a collection of examples. The examples are taken largely from automotive practice. The book is lithoprinted instead of being printed from type.

Sterling Crankless Engine—

Upper and lower sections of Sterling crankless oil burning engine



STERLING ENGINE CO., Buffalo, N. Y., which two years ago first showed a crankless compression-ignition, oil-burning, two-stroke engine at the National Motorboat Show, has now placed one model of this engine in production and plans to bring out two other, larger sizes in the course of the coming year. It may be recalled that the engine is of the swashplate type and is being built under Michell patents. The original design was due to A. G. M. Michell, an Australian inventor whose thrust bearings are used very extensively to take the propeller thrust on ocean liners. During the period since the first Sterling crankless engine was completed, much experimental work has been done, and a number of different sizes have been built. The first two engines of the latest model to be completed were installed in a 65-ft. yacht *Silverheels* of Charles A. Criqui, president of the Sterling Engine Co. Mr. Criqui left Buffalo in this yacht late in November, passed through the Barge Canal to New York and is continuing his journey through

the Eastern Intracoastal Canal to Florida.

The new engine has four horizontal cylinders of $4\frac{1}{4}$ -in. bore and $5\frac{7}{16}$ -in. piston stroke. Each cylinder contains two opposed pistons, so there are eight pistons in all, and the total piston displacement is 620 cu. in. The four cylinders are arranged with their axes at the corners of a square, and through the center of this square passes the powershaft, the equivalent of the ordinary crankshaft. It carries two inclined disks or swashplates, one at each end of the cylinders, and is carried in three bearings with pressure lubrication. The combustion takes place between the two pistons in each cylinder, and there is no cylinder head. For this reason the engine block is not subjected to any stresses in a direction parallel with the cylinder axes, the forces of explosion being taken on the inclined disks and the shaft on which they are mounted, which accounts for the relatively large diameter of this shaft.

The force exerted on the pistons by the burning gases is transmitted to

the inclined disks through what may be called connecting rods. Unlike the connecting rods of conventional engines, these have no swinging motion but move in straight lines. With the pistons the rods have a ball-and-socket connection, while with the disk they connect through a pair of babbitt-faced pads which have socket mountings and can rotate around the center of the socket and thus keep in accurate alignment with the disk, whose inclination at the contact surfaces of the pads changes continuously. The design of the pads is based on the same principle as that of the Michell thrust bearing, that is to say, the center of the pressure exerted on the pad by the connecting rod is closer to the trailing than to the leading edge.

In order to permit of efficient scavenging and a slight degree of supercharging, the two inclined disks are mounted on their shaft slightly out of phase, so that the two pistons in each cylinder do not start on a stroke at the same time. One of the pistons controls the transfer ports, the

New oil-burning, two-stroke power-plant is to be built primarily for marine use, but is adaptable for other purposes

other the exhaust ports, and by providing this phase difference it is made possible to open the exhaust ports before the transfer ports (or scavenging ports) and yet close the exhaust ports before the transfer ports.

An air compressor is provided at one end of the engine and supplies air under a pressure of 3-4 lb. per sq. in. for scavenging and charging the cylinders. The air enters the cylinders through ports in the cylinder walls which are so shaped as to impart a swirling motion to it. The compression ratio has a nominal value of 17:1 and the compression pressure is given as 500-550 lb. per sq. in. The engine has a rating of 150 hp. at 1200 r.p.m., which corresponds to a b.m.e.p. of 80 lb. per sq. in.—quite a high value for a two-stroke engine.

In two-stroke oil engines it is something of a problem to keep the temperature of the piston head within reasonable limits, and in the development of this engine it was therefore decided to limit the cylinder bore to such a size that the pistons could be effectively cooled without any other means than the use of the lubricating oil. Fuel injection is direct into the combustion chambers, under a pressure of 2500 lb. per sq. in. Either No. 2 or No. 3 Diesel fuel can be used, and

the specific consumption is said to range between 0.42 and 0.45 lb. per hp.-hr. A mechanical efficiency, including the scavenging pump, of 85 per cent is claimed. It is recommended that the water be allowed to overflow at 130-140 deg. F. No. 30 lubricating oil is recommended, a supply of 6 gals. being required to fill the sump. Oil is supplied to the main bearings under pressure and to the disks, cylinders, etc., by spray. The oil is cooled and filtered.

An electric starter engages the fly-wheel through a Bendix system, and generator mounted on the engine supplies current for keeping the batteries charged.

Although the engine is to be built primarily for marine use, it is said to be readily adaptable for other purposes. In marine applications a planetary reverse gear and a 2:1 reduction gear are combined with the engine in a

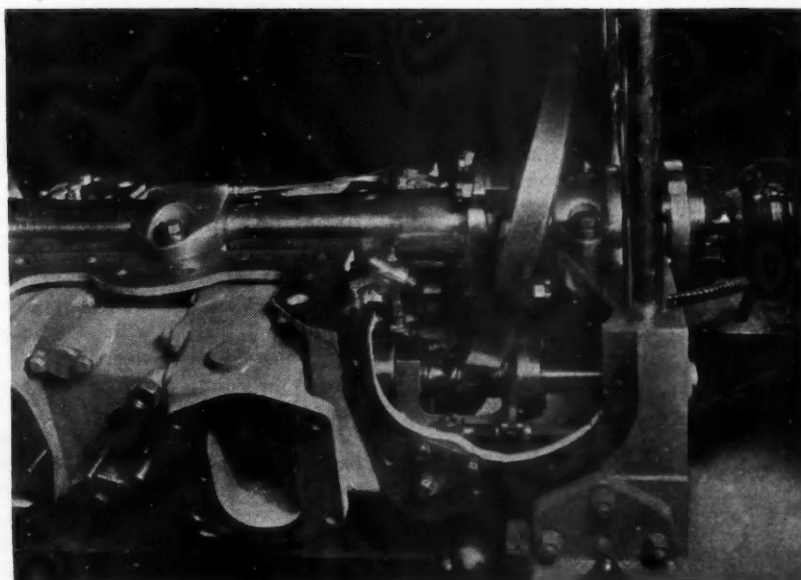
single unit, so that the standard propeller speed is 600 r.p.m.

The outside design on general form of the engine is due to Count Alexis de Sakhnoffsky.

One of the photographs reproduced herewith shows the upper and lower sections of the new engine. The upper section has been raised so as to give a clear view of the internal parts. Extending through the center may be seen the power shaft, from which the power is taken and which carries the two inclined disks. Near the bottom may be seen the connecting rods extending from the pistons past the inclined disks and engaging the disks by means of babbitt-faced pads. In both sections of the housing may be seen the intake or transfer ports at the left and the exhaust ports at the right.

The other photo shown is a close-up of one of the inclined disks. Near the bottom of the disk is shown the ball-and-socket-mounted pad bearing of the connecting rod in contact with the disk. It is the tangential component of the force exerted by the pad on the disk that causes the latter and its shaft to revolve. In the foreground on the left may be seen the exhaust connection, and at the extreme left a part of the inlet connection. At the top is shown the heavy drive shaft with its central bearing.

Close-up of ball-and-socket-mounted pads bearing on inclined disk



Part 4

Installments 1, 2 and 3 appeared in the Nov. 7, Nov. 28 and Dec. 12 issues of
AUTOMOTIVE INDUSTRIES

This is the final article in the series

THE average American consumer knows comparatively little about just what cars possess the catchily trade-named features that play so important and costly a role in the automobile industry's big advertising show.

The attempts of Mr. and Mrs. Public to associate these special features with the sponsoring cars are even less impressive than their far from successful recognition-and-memory efforts in connection with that other bulwark of automobile advertising—the slogan.

As is the case with their understanding of what cars have such non-exclusive types of construction as all-steel bodies and one-piece steel roofs, people generally have a fair idea which makes possess and advertise just a few of the special features, and very, very little knowledge of which cars have the rest of them.

Men far outdistance women in special feature recognition; the women excel only on features which concern riding qualities and ease of steering.

The amount of money spent to publicize a car's possession of an exclusive or semi-exclusive feature seems usually to have much to do with its recognition by consumers as belonging to that car. Sometimes heavy advertising has very little effect in this respect and, in a few cases, a car-feature combination has become grafted upon the public consciousness with the expenditure of very few advertising dollars.

Men are extremely successful in naming the number of cylinders in the engine of the various makes of passenger cars, with notable exceptions in the cases of certain cars. Women, while less proficient in this test, show a surprising degree of accuracy in naming the number of cylinders in the various passenger car engines.

In investigating the consumer's consciousness of the exclusive and semi-exclusive features usually designated by trade-names, the interviewers presented the responders with a check-list of 21 advertised automobile mechanical devices or other construction elements, ask-



How Much

ing them to name the car or cars having each feature.

The question was: "What cars advertise these features?"

Features possessed by 22 1936-model cars were included. It was found that some manufacturers had made liberal use of feature-describing phrases and that others had promoted their distinctive features feebly or not at all. Some cars were, therefore, represented by two features or several, and others by one or none. The criterion of selection was solely the features' continued and prominent recurrence verbally or pictorially in such advertising as was done. Their probable importance to the consumer was not considered: that was one of the points upon which we sought light.

The question sought the spontaneous reactions of the responders. More persons might have named Chevrolet, for example, as having a "turret top" if they had been asked directly whether that car had this construction, but as it

is the findings indicate, significantly, how many persons could associate the "turret top" with the Chevrolet name *without prompting*. The question is thus in line psychologically with our technique in the rest of the study in serving to measure the types of consumer consciousness which advertising are generally expected to develop.

The intention here was fourfold:

1. To find out what generally publicized special features rank best—and what rank worst—in point of consumer car-identification.
2. To learn, conversely, how the individual cars score in consumer identification of all the features we included.
3. To develop comparative data on men's and women's car-and-feature identification performances, and on the special feature knowledge of age and car ownership sub-groups.
4. To produce conclusions as to the

*President, Facts, Incorporated.



By Thomas G. MacGowan*

Automobile Advertising Sticks?

Survey exposes failure of public to recognize many points stressed by car advertisers and shows that only important features register in the consumer's mind

relative success of types of feature promotion in penetrating and lodging in the public consciousness.

There seems to be three main types of special features: those which appear on only one car; those which are common to the various makes produced by one company; and those which are found on the cars of several manufacturers.

Of the last type are the Graham and Auburn superchargers and the overdrive. The latter, in one form or another, is used upon eleven makes of cars produced by nine companies. (Overdrive was included here rather

than among the non-exclusive feature questions previously reported upon because of the special trade-name complication.)

From our findings only a few features emerge with correct identification scores which can really be termed satisfactory. Notable among these are two which have had the advantage of a comparatively small amount of advertising: Cord's "front drive," an easy first among the 21 listed, and the same car's "disappearing headlights," which took fourth place.

As might have been expected, General Motors' "no-draft ventilation" and "turret top" placed very well, as

did Nash's long-advertised "twin ignition" and Studebaker's exclusive "hill holder."

Another highlight is the very poor rating of the Ford-Lincoln-Zephyr "center-poise ride" and the low position of all Hudson Terraplane's features except the "electric hand."

Especially interesting is the men's great lead over women in this feature identification race, the clear victory of the younger age groups, the good showing of the oldest people, and the discovery that low-medium priced car owners are best of all at correctly pairing special features with the cars that advertise them.

Now, how may our story of feature identification failure be summed up in a few words?

Not one of the features could be identified correctly with all cars having it by 75 per cent or more of the responders.

Only two (9.53 per cent) could be identified correctly by 50 to 75 per cent of the interviewees.

There were four (19.04 per cent) that were identified properly by 25 to 50 per cent of the people questioned.

A total of 15 (71.43 per cent, or nearly three-quarters) could be identified by fewer than 25 per cent.

If we pool all efforts to identify and all refusals to try, amounting to a total of 13,419, we find there were 5535 responses and 7884 failures to respond. In just 58.75 per cent of the cases the interviewees would not attempt an answer of any sort.

The actual attempts were not bad, especially if we consider "partly right" identifications—those in which one or more but not all cars using a feature were rightly named. The summary:

| | No. | Per Cent |
|-----------------------------------|------|----------|
| Right identifications | 2377 | 17.71 |
| Partly right identifications..... | 1566 | 11.67 |
| Wrong identifications | 1592 | 11.87 |
| Failures to respond | 7884 | 58.75 |

How much worse the responders were here than in their slogan-identifying ef-

[Table 1]

Consumers' Ability to Identify Special Features With Cars Advertising Them*

| FEATURES | CORRECT ANSWERS | ALL PERSONS INTERVIEWED (639) | | | | | | BREAKDOWN BY SEXES | | | | | |
|--------------------------------|----------------------|-------------------------------|-------|-------------------|------------------------------|-----------|----------------|------------------------------|---------|----------------|---------|-------|---------|
| | | Correct | | Partially Correct | Correct or Partially Correct | Incorrect | Not Responding | Correct or Partially Correct | | Not Responding | | | |
| | | No. | % | % | % | % | % | Men % | Women % | Men % | Women % | Men % | Women % |
| Front drive | Cord | 445 | 69.64 | | 69.64 | 2.50 | 27.86 | 74.52 | 47.86 | 22.99 | 48.57 | | |
| No-draft ventilation | General Motors | 339 | 53.05 | 22.22 | 75.27 | 3.29 | 21.44 | 76.82 | 68.38 | 20.31 | 26.50 | | |
| Twin ignition | Nash | 281 | 43.97 | | 43.97 | 9.86 | 46.17 | 46.36 | 33.33 | 42.72 | 61.54 | | |
| Disappearing headlights | Cord | 279 | 43.66 | | 43.66 | 8.61 | 47.73 | 47.51 | 26.50 | 43.87 | 64.97 | | |
| Turret top | General Motors | 274 | 42.88 | 21.91 | 64.79 | 10.17 | 25.04 | 67.24 | 53.85 | 22.80 | 35.04 | | |
| Hill holder | Studebaker | 247 | 38.65 | | 38.65 | 7.98 | 53.37 | 40.42 | 30.77 | 51.34 | 62.39 | | |
| Electric hand | Hudson; Terraplane | 113 | 17.68 | 34.90 | 52.58 | 6.89 | 40.53 | 56.70 | 34.19 | 36.40 | 58.97 | | |
| Rear seat sleeping arrangement | Nash; LaFayette | 79 | 12.36 | 42.41 | 56.77 | 11.74 | 33.49 | 56.13 | 48.72 | 32.38 | 38.46 | | |
| Shockproof steering | Chevrolet | 77 | 12.05 | | 12.05 | 22.22 | 65.73 | 11.11 | 16.24 | 65.13 | 68.38 | | |
| Supercharger | Graham; Auburn | 71 | 11.11 | 37.87 | 48.98 | 11.58 | 39.44 | 53.83 | 27.35 | 34.29 | 62.39 | | |
| Airglide ride | Dodge | 48 | 7.51 | | 7.51 | 32.29 | 60.10 | 6.51 | 11.96 | 59.77 | 61.54 | | |
| Shockless steering | De Soto | 30 | 4.69 | | 4.69 | 13.77 | 81.54 | 3.83 | 8.55 | 81.80 | 80.34 | | |
| Double braking system | Hudson; Terraplane | 23 | 3.60 | 8.76 | 12.36 | 10.64 | 77.00 | 14.56 | 2.56 | 75.29 | 84.62 | | |
| Bridge-truss construction | Lincoln-Zephyr | 22 | 3.44 | | 3.44 | 20.66 | 75.90 | 3.03 | 1.71 | 72.99 | 88.89 | | |
| Gas-saver transmission | De Soto | 20 | 3.13 | | 3.13 | 13.93 | 82.94 | 2.68 | 5.13 | 82.76 | 83.76 | | |
| Radial safety control | Hudson; Terraplane | 15 | 2.35 | 4.38 | 6.73 | 3.76 | 89.51 | 6.32 | 8.55 | 89.27 | 90.60 | | |
| Rhythmic ride | Hudson; Terraplane | 7 | 1.10 | 2.35 | 3.45 | 7.20 | 89.35 | 3.07 | 5.13 | 89.08 | 90.60 | | |
| Tru-line steering | Hudson; Terraplane | 5 | .78 | 3.29 | 4.07 | 6.26 | 89.67 | 3.26 | 7.69 | 90.23 | 87.18 | | |
| Automatic draft eliminator | Hudson; Terraplane | 2 | .31 | 1.72 | 2.03 | 30.05 | 67.92 | 2.11 | 1.71 | 66.86 | 72.65 | | |
| Overdrive devices | Eleven cars† | | | 41.63 | 41.63 | 2.97 | 55.40 | 44.06 | 30.77 | 52.68 | 67.52 | | |
| Center-poise ride | Ford; Lincoln-Zephyr | | | 23.63 | 23.63 | 12.68 | 63.69 | 24.90 | 17.95 | 61.88 | 71.79 | | |
| TOTALS | | 2377 | 17.71 | 11.67 | 29.38 | 11.87 | 58.75 | 30.75 | 23.28 | 56.90 | 67.03 | | |

* This table presents the percentage relationships of the number of persons who responded in various ways or not at all to the whole number interviewed.

† Auburn; Chrysler; Cord; De Soto; Graham; Hummobile; LaFayette; Nash; Pierce-Arrow; Reo; Studebaker.

forts appears in a comparison of these figures with the corresponding results on the slogan question, where the percentages were: right, 27.03; partly right, 1.21; wrong, 18.47; and no response, 53.29.

Fewer than half the attempted feature identifications were completely correct. Dividing up the actual attempts, we find this: right, 42.95 per cent; partly right, 28.29 per cent; and wrong, 28.76 per cent. With slogans, the story was: right, 57.87 per cent; partly right, 2.60 per cent; and wrong, 39.53 per cent.

On features, people made fewer fully correct identifications than on slogans, with fewer wholly wrong attempts, and a larger number of partly correct efforts. We can't, however, get a complete feature-slogan identification picture simply by adding right and partly right attempts (which would give slogans the edge) because the idea has been to test all-over consciousness on a question involving many more multiple-car features than there were multiple-car slogans.

The 21 features and the 22 cars using them resolve themselves into 48 car-and-feature combinations. Considering the scores of all these combinations, we find that:

No car was identified as having any one feature by 75 per cent or more of the responders.

Only eight cars were identified as having any one feature by from 50 to 75 per cent of the people.

Fourteen were identified with one feature by from 25 to 50 per cent of them.

The remainder of these 48 car-and-one-feature combinations, 26, were recognized by fewer than 25 per cent of the persons interviewed.

The results, bad as they are, are a good deal better for men than for women:

| | Men (Per Cent) | Women (Per Cent) |
|-----------------------|----------------|------------------|
| Right or partly right | 30.75 | 23.28 |
| Wrong | 12.35 | 9.69 |
| Failures to respond | 56.90 | 67.03 |
| | 100.00 | 100.00 |

Looking at the sex breakdown of actual attempts to answer, we find that men were again out in front with a combined percentage of right or partly right answers of 71.34 as compared with one of 70.62 for women; this is in striking reversal of the situation on slogans, where women's attempts at identification were more accurate.

Slogan recognition became poorer as we went up the ladder by age groups; so also in general with features, which are most often spotted correctly by younger people, except that the oldest group of all noses out the group aged from 40 to 49. Here, omitting the responses of the few interviewees under 20, are the percentages of correctness by age:

| Age | Per Cent |
|-------------|----------|
| 20 to 29 | 33.94 |
| 30 " 39 | 27.86 |
| 40 " 49 | 25.51 |
| 50 and over | 26.19 |

The youngest people were prone to attempt identifications. Analysis of actual attempts made shows the highest percentage of accuracy for the groups from 40 to 49, whose work on slogans was also most accurate: 20-29, 71.34; 30-39, 69.58; 40-49, 74.44; 50 and over, 70.71.

Owners of cars with f.o.b. prices from \$651 to \$975 have the best percentage of correct identifications to all persons questioned. Eliminating the responses of those whose cars cost from \$1601 up as being too few to be considered, we find this:

| Price | Per Cent |
|-----------------|----------|
| Up to \$650 | 30.53 |
| \$651 to \$975 | 32.22 |
| \$976 to \$1600 | 28.51 |

The winning price group most frequently responded and had the best percentage of accuracy in actual responses given, 71.26, followed by the low-priced group, with 70.63. Owners in the \$976 to \$1600 group had an accuracy percentage of 70.05.

Turning, now, to the score sheet of the 21 features (Table 1), we are at once confronted with the astonishing win of the "front drive" which, correctly identified with Cord by 445 of the 639 persons interviewed, or 69.64 per cent, outstripped many older and far more heavily advertised features. We also note the appearance of Cord's "disappearing headlights" in fourth place, recognized and identified by 43.66 per cent of the people in the survey.

These results were, perhaps, foreshadowed by Cord's rating in the 1935 auto show research as the "best-looking car," clearly indicating that the Cord made immediate, strong and favorable impressions. Now we know that its subsequent street and showroom appearance must also have been highly effective, and that word-of-mouth advertising must have gotten in its work. Considering the limited Cord advertising and even allowing for the influence of carried-over impressions of the old Cord, the recognition of such a feature as "front drive," not concerned directly with appearance, must remain extraordinary.

General Motors takes second honors with "no-draft ventilation," the only feature besides "front drive" to score over 50 per cent, and the "twin ignition" feature of Nash comes next.

Here are the ten leading features, with the percentages of recognition of all cars possessing them:

| Features | Per Cent |
|-------------------------------------------------------|----------|
| Front drive (Cord)..... | 69.64 |
| No-draft ventilation (General Motors)..... | 53.05 |
| Twin ignition (Nash)..... | 43.97 |
| Disappearing headlights (Cord)..... | 43.66 |
| Turret top (General Motors)..... | 42.88 |
| Hill holder (Studebaker)..... | 38.65 |
| Electric hand (Hudson; Terraplane)..... | 17.68 |
| Rear seat sleeping arrangement (Nash; LaFayette)..... | 12.36 |
| Shockproof steering (Chevrolet)..... | 12.05 |
| Supercharger (Graham; Auburn)..... | 11.11 |

If we consider the rankings of one-car-and-one-feature combinations, a somewhat different story appears, for many persons could name one or more cars as having a certain feature, but could not name it as possessed by others. Below are the percentages for the 15 cars which led in their identification with one feature. In this compilation, mentions of "General Motors cars" are, of course, added to the individual mentions of each of the General Motors makes:

| Features | Per Cent |
|----------------------------------------|----------|
| Chevrolet (no-draft ventilation)..... | 71.98 |
| Cord (front drive)..... | 69.64 |
| Chevrolet (turret top)..... | 59.62 |
| Buick (no-draft ventilation)..... | 56.96 |
| Oldsmobile (no-draft ventilation)..... | 55.55 |
| Pontiac (no-draft ventilation)..... | 54.30 |
| Cadillac (no-draft ventilation)..... | 53.21 |
| La Salle (no-draft ventilation)..... | 53.05 |
| Oldsmobile (turret top)..... | 46.64 |
| Buick (turret top)..... | 45.38 |
| Nash (twin ignition)..... | 43.97 |
| Cord (disappearing headlights)..... | 43.66 |
| Pontiac (turret top)..... | 43.66 |
| Cadillac (turret top)..... | 42.88 |
| La Salle (turret top)..... | 42.88 |

Examination of Table 1 will show that women were less successful than men in giving correct or partially correct identifications of all but seven of the 21 features. The seven were all among the low-scoring features. These, with the total percentages of complete and partial correctness for the sexes, were:

| Features | Men (Per Cent) | Women (Per Cent) |
|--------------------------------------|----------------|------------------|
| Shockproof steering (Chevrolet)..... | 11.11 | 16.24 |
| Airglide ride (Dodge)..... | 6.51 | 11.96 |

| | | |
|-------------------------------------------------|------|------|
| Shockless steering (De Soto)..... | 3.83 | 8.55 |
| Gas-saver transmission (De Soto)..... | 2.68 | 5.13 |
| Radial safety control (Hudson; Terraplane)..... | 6.32 | 8.55 |
| Rhythmic ride (Hudson; Terraplane) .. | 3.07 | 5.13 |
| Tru-line steering (Hudson; Terraplane) .. | 3.26 | 7.69 |

Women excelled on all three steering features, two of three "ride" features (the two whose names were directly suggestive of comfort), and they won on only two other features. They proved particularly bad in comparison with men on: "front drive"; "disappearing headlights"; "supercharger"; "double braking system"; and "bridge-truss construction."

Now for the features most often incorrectly identified. Here are the ten worst offenders in this respect, with the percentages of all responders who ascribed them to cars not possessing them:

| Features | Per Cent |
|-------------------------------------------------------|----------|
| Airglide ride (Dodge)..... | 32.39 |
| Automatic draft eliminator (Hudson; Terraplane)..... | 30.05 |
| Shockproof steering (Chevrolet)..... | 22.22 |
| Bridge-truss construction (Lincoln-Zephyr)..... | 20.66 |
| Gas-saver transmission (De Soto)..... | 13.93 |
| Shockless steering (De Soto)..... | 13.77 |
| Center-poise ride (Ford; Lincoln-Zephyr)..... | 12.68 |
| Rear seat sleeping arrangement (Nash; LaFayette)..... | 11.74 |
| Supercharger (Graham; Auburn)..... | 11.58 |
| Double-braking system (Hudson; Terraplane)..... | 10.64 |

And here are the ten features on which people most often failed to attempt an identification, with the percentages of all persons interviewed who

would not try to link them with any make of automobile:

| Features | Per Cent |
|------------------------------------------------------|----------|
| Tru-line steering (Hudson; Terraplane)..... | 89.67 |
| Radial safety control (Hudson; Terraplane)..... | 89.51 |
| Rhythmic ride (Hudson; Terraplane)..... | 89.35 |
| Gas-saver transmission (De Soto)..... | 82.94 |
| Shockless steering (De Soto)..... | 81.54 |
| Double-braking system (Hudson; Terraplane)..... | 77.00 |
| Bridge-truss construction (Lincoln-Zephyr)..... | 75.90 |
| Automatic draft eliminator (Hudson; Terraplane)..... | 67.92 |
| Shockproof steering (Chevrolet)..... | 65.73 |
| Center-poise ride (Ford; Lincoln-Zephyr)..... | 63.69 |

We may learn much from a study of the list of cars most often erroneously named as having one feature or another. Here are the ten cars most often so mentioned:

| | |
|-----------------|-----|
| Chrysler..... | 289 |
| Chevrolet..... | 262 |
| Buick..... | 246 |
| Oldsmobile..... | 235 |
| Cadillac..... | 195 |
| Pontiac..... | 190 |
| Plymouth..... | 190 |
| La Salle..... | 169 |
| Dodge..... | 161 |
| De Soto..... | 128 |
| Studebaker..... | 97 |

When several cars all have a given feature, how do they compare in consumer recognition of that fact? Some most interesting differences appear.

Chevrolet is more frequently identified as having the high-ranking "no-draft ventilation" than is any other General Motors car: it was named by 71.98 per cent of the interviewees as having the feature. The other cars' percentages were: Buick, 56.96; Oldsmobile,

[Table 2]

Consumers' Knowledge of the Number of Cylinders of Passenger Cars

| CARS | Average Percentages Of Interviewees Who Gave Correct Answers | ALL PERSONS INTERVIEWED (639) | | | | | BREAKDOWN BY SEXES | |
|-------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------|--------|--------|--------|--------|------------------------------------------------------------------|-------------|
| | | Percentages Of All Persons Interviewed Who Mentioned the Various Cylinder Numbers | | | | | Average Percentages Of All Interviewees Who Gave Correct Answers | |
| | | († Correct Mentions) | | | | | Men | Women |
| | | 4 | 6 | 8 | 12 | 16 | Percentages Of All Interviewees Who Failed To Respond | |
| Chevrolet..... | 63.88 | 4.38 | 63.88† | 3.44 | .16 | .16 | 13.93 | 86.97 70.09 |
| Ford..... | 63.57 | 7.51 | 7.82 | 83.57† | 1.56 | .16 | 13.61 | 87.16 65.52 |
| Plymouth..... | 81.22 | 4.23 | 61.22† | 5.63 | .16 | .16 | 15.18 | 84.87 64.96 |
| Buick..... | 77.93 | .63 | 39.12 | 77.93† | 3.44 | .31 | 16.12 | 80.65 65.81 |
| Dodge..... | 75.59 | 1.41 | 75.59† | 28.48 | .94 | .16 | 16.74 | 78.54 62.39 |
| Terraplane..... | 72.61 | 1.25 | 72.61† | 19.41 | .16 | .16 | 20.19 | 76.44 65.56 |
| Oldsmobile..... | 71.28 | .63 | 72.61† | 69.95† | .16 | .16 | 17.21 | 75.10 64.28 |
| Chrysler..... | 69.02 | 1.09 | 64.79† | 73.24† | 5.95 | .63 | 16.59 | 71.74 66.84 |
| Pontiac..... | 68.31 | .31 | 71.36† | 65.26† | .31 | .16 | 17.53 | 72.32 60.43 |
| De Soto..... | 67.76 | 1.56 | 67.76† | 29.26 | .63 | .16 | 20.81 | 70.11 67.26 |
| La Salle..... | 67.29 | .16 | 6.89 | 67.29† | 25.51 | 3.76 | 21.28 | 70.08 51.28 |
| Packard..... | 66.59 | .16 | 20.97 | 70.58† | 62.60† | 12.83 | 16.90 | 69.16 55.13 |
| Cadillac..... | 66.04 | .31 | 2.97 | 63.54† | 70.89† | 63.89† | 17.21 | 69.92 48.89 |
| Lincoln..... | 65.10 | .16 | 2.03 | 47.10 | 65.10† | 16.30 | 16.62 | 67.05 56.41 |
| LaFayette..... | 63.69 | .94 | 63.69† | 12.36 | 1.25 | .31 | 27.23 | 66.16 39.32 |
| Studebaker..... | 62.92 | .47 | 58.22† | 67.61† | 3.44 | .47 | 19.72 | 66.10 48.72 |
| Nash..... | 57.98 | 1.10 | 54.77† | 61.19† | 1.68 | .16 | 21.28 | 60.73 45.73 |
| Cord..... | 57.90 | .16 | 6.10 | 57.90† | 31.77 | 6.42 | 30.62 | 55.56 25.04 |
| Hudson..... | 53.91 | .31 | 36.18† | 71.67† | 3.44 | .16 | 20.86 | 66.23 43.59 |
| Graham..... | 52.74 | .47 | 52.74† | 50.23 | 2.19 | .16 | 26.92 | 56.13 37.61 |
| Pierce-Arrow..... | 50.47 | .16 | 8.61 | 51.64† | 49.30† | 12.68 | 25.98 | 61.82 44.45 |
| Hupmobile..... | 47.19 | .94 | 35.68† | 58.89† | 1.25 | .16 | 26.76 | 48.69 40.60 |
| Auburn..... | 46.56 | .63 | 31.14† | 61.97† | 23.94 | 2.97 | 24.73 | 48.69 35.47 |
| Reo..... | 43.35 | .47 | 43.35† | 48.04 | 3.76 | .31 | 28.17 | 46.17 30.77 |
| Willis..... | 29.42 | 29.42† | 40.93 | 11.74 | .94 | .16 | 33.02 | 31.80 16.00 |
| AVERAGE..... | 63.29 | | | | | | 21.08 | 68.08 49.40 |

bile, 55.55; Pontiac, 54.30; Cadillac, 53.21; and LaSalle, 53.05.

The "turret top" feature was also most often identified as belonging to Chevrolet, but with the much lower recognition percentage of 59.62. Then came Oldsmobile, with 46.64; Buick, with 45.38; Pontiac, with 43.66; and Cadillac and LaSalle, each with 42.88.

Electric Hand

The "electric hand" went over somewhat better for Hudson than for Terraplane. Hudson was named by 38.18 per cent of the persons interviewed; Terraplane, by 32.08 per cent. The only car to receive many wrong mentions under "electric hand" was Reo, named by 4.04 per cent of the interviewees.

The "rear seat sleeping arrangement" was similarly more often identified by the more expensive car of the Nash-LaFayette line. Here Nash's percentage of consumer identification was 34.43, while LaFayette's was 32.71.

Graham beat Auburn in recognition as having the "supercharger," with a percentage of 34.43 as against Auburn's of 25.66.

The Hudson-Terraplane "double-braking system" was connected with Hudson by only 8.45 per cent of the persons interviewed, and with Terraplane by 7.51 per cent of them; 4.54 per cent of the responders thought Plymouth had a "double-braking system."

Among the other low-recognition Hudson-Terraplane features Hudson led with all except "radial safety control." There the Terraplane rating was 4.69 per cent; Hudson's was 4.38 per cent. Here's the list: "rhythmic ride," Hudson, 2.82 per cent, and Terraplane, 1.72 per cent; "tru-line steering," Hudson, 2.50 per cent, and Terraplane, 2.35 per cent; and "automatic draft eliminator," Hudson, 1.56 per cent, and Terraplane, 0.78 per cent.

There were many mentions of the General Motors cars as having the "automatic draft eliminator," ranging from a 20.5 per cent representation for Chevrolet to percentages of 14.5 each for LaSalle and Cadillac.

Overdrive devices known both by the overdrive name and various special terms brought forth a most unequal response, with the Chrysler far in the lead. Here is the list, in order of consumer identification percentages: Chrysler, 20.81; Nash "automatic cruising gear," 7.20; Studebaker, 7.04; DeSoto "gas-saver transmission," 5.16; Reo, 3.13; Auburn "dual ratio," 2.97; LaFayette "automatic cruising gear," 2.82; Graham, 0.78; Cord "dual ratio," 0.31; and Hupmobile and Pierce-Arrow, none. Dodge was named as having an overdrive by 4.38 per cent of the responders.

DeSoto's "gas-saver transmission," which incorporated an overdrive, was given separate listing also, and had a recognition percentage of 3.13.

"Center-poise ride" was identified with Ford by only 23.47 per cent of the responders—truly a small enough figure for so widely advertised a feature—and its recognition score with Lincoln-Zephyr, 0.16, is negligible, especially when the advertising outlay is considered.

What general conclusions may be drawn from all these findings?

The leading features are all short, "punchy" and possessed of rhythm, like the leading slogans.

Two leaders, "turret top" and "hill holder," make use of alliteration, but other alliterative features, notably "rhythmic ride," do badly.

Features incorporating unusual or tricky, hard-to-pronounce words, such as "radial," "tru-line," "rhythmic," "center-poise" and "bridge-truss," don't do very well.

The features that click fairly well concern mechanical or construction features of importance. They *never* have to do with steering or riding qualities.

New features can and have quickly taken root in the public mind: witness the Cord features and Studebaker's "hill holder." But the expenditure of much advertising money is by no means necessary if the feature is sufficiently unique and, conversely, large advertising outlay definitely may fail to impress a feature upon the public.

Number of Cylinders

We now come to the results of another phase of our investigation of automobile features in which we undertook to study the consumer's knowledge of the number of cylinders in the various motors.

How many people know the Ford has an 8-cylinder motor? Do as many know that Olds make an "8" as know about the larger-selling "6"? Do people in general know that all Lincolns are 12-cylinder cars? Do Dodge and DeSoto often get credit for making "8's" which they don't produce? Is it commonly known that the 1936 Willys is a "4"?

In getting the answers to such questions as these we gave our automobile knowledge-and-memory test subjects another check-list, which included 25 American passenger cars. After each car-name there appeared the numerals "4-6-8-12-16." The responders were asked: "How many cylinders have these cars?" and were requested to circle the right number or numbers.

The 639 responders were very good at cylinder identification. The average percentage of those interviewed who

failed to respond was only 21.08; and the average percentage of the interviewees who gave correct answers was 63.29, which is by far the highest correctness percentage they have scored on the questions thus far reported.

Men knew much more about cylinders than did women. Their percentage of average correctness was 66.08, but that of women, 49.40, is, nevertheless, surprisingly good.

The responses for the individual cars show that, to a certain extent, people's ability to give cylinder identifications is in direct ratio to both the sizes of the advertising appropriations and the sale of the cars. Thus the ranking, in point of accurate identification, is led by Chevrolet, Ford and Plymouth, in the order named. There are, however, many exceptions to this rule, as will be seen from the listing in Table 2.

The outstanding findings seem to be:

Chevrolet, Ford and Plymouth, with accuracy percentages of 83.88, 83.57 and 81.22, do amazingly well.

Willys, at the bottom of the list, drew more wrong answers than right ones: 40.53 per cent of the interviewees thought it a "6"; only 29.42 a "4,"

In only one other case did incorrect responses outnumber correct ones: 48.04 per cent of the responders mentioned a Reo "8"; only 43.35, the Reo "6."

Buick, an "8," had a high percentage of "6" responses, 39.12. Graham, a "6," was identified as being an "8" by 50.23 per cent of the interviewees; 47.10 per cent of them, nearly half, believed there was a Lincoln "8," whereas all Lincolns are "12's."

There were a comparatively large number of mentions of non-existent "12's" for LaSalle, Cord and Auburn.

Packard, Lincoln and Pierce-Arrow all get credit for a "16" they don't make. Cadillac's correct "16" mentions were about equal to those of the "8."

Chrysler, Nash, Studebaker, Hupp, Hudson and Auburn were all more frequently mentioned as having "8's" than for the lower-priced and larger-selling "6's."

More than one-fifth of the persons interviewed thought the 1936 Packard line already included a "6."

Conclusions

This completes our report and brings us to a consideration of its net results. What, briefly are the outstanding highlights of this investigation, the first comprehensive study of the automobile consumer's advertising consciousness?

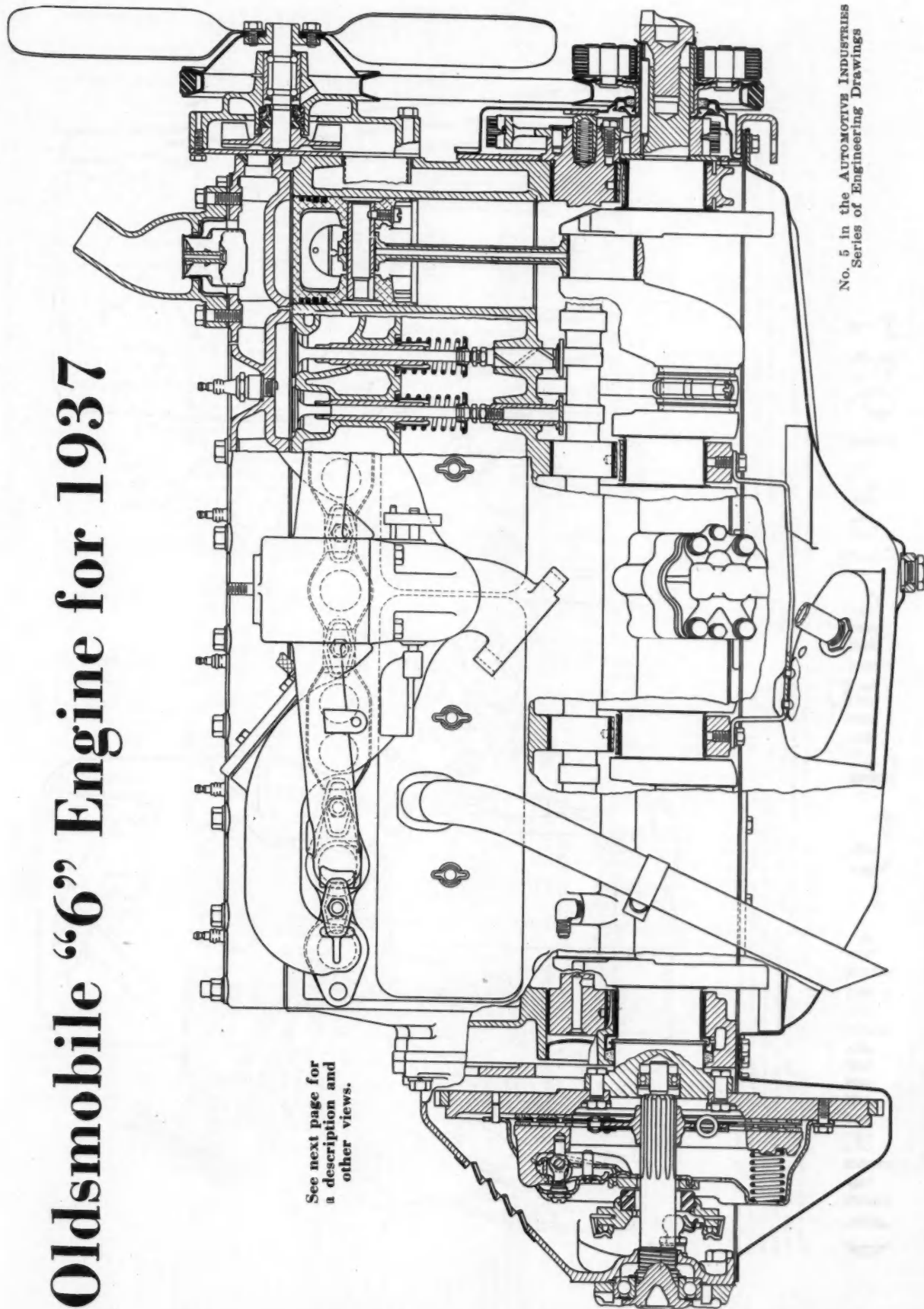
These conclusions seem the most important:

1. People are in general extremely

(Turn to page 866 please)

Oldsmobile "6" Engine for 1937

See next page for
a description and
other views.

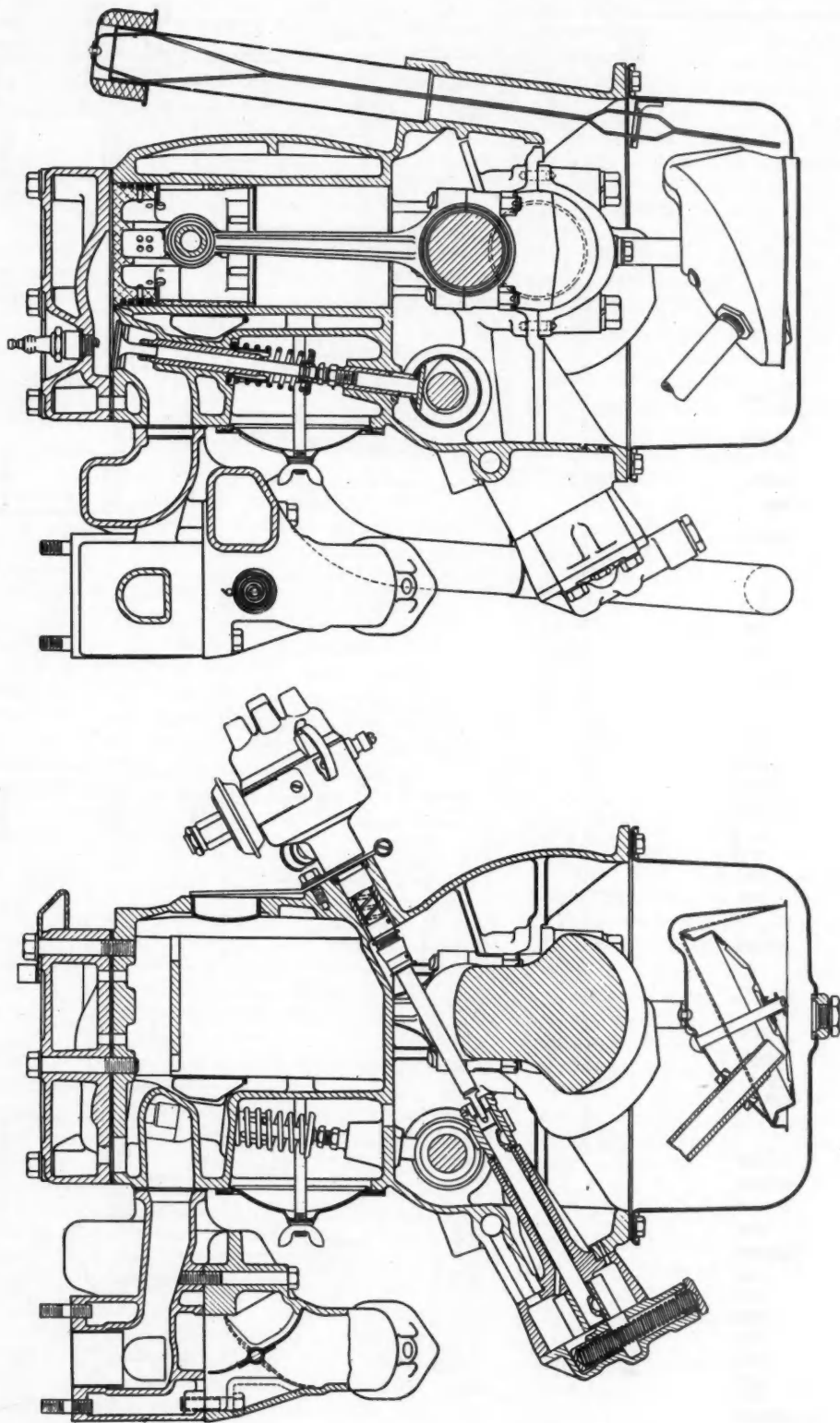


No. 5 in the AUTOMOTIVE INDUSTRIES
Series of Engineering Drawings

Oldsmobile "6" Engine for 1937

This engine has a bore and stroke of 3-7/16 by 4 1/4 in. Its displacement is 229.7 cu. in. and it is rated 95 hp. at 3400 r.p.m. Features of the engine are full-length water jackets and jet cooling of the valve pockets. The pistons are of aluminum alloy and are anodized. There are four main bearings on the crankshaft, which latter is provided with counterweights. Oil pump and ignition unit are driven by a shaft inclined at 45 deg. and the oil pump therefore is outside the crankcase. It has the

pressure relief valve combined with it. Note the inclination of the valve stem to reduce the capacity of the valve pocket, the thrust washers at the front main bearing where thrust loads are carried, and the vibration damper at the forward end of the crankshaft. The cylinder jacket is barrel-shaped in section and stiffened by ribs, probably to make the engine more quiet. Arrangement of the manifold is clearly shown in the transverse section. The pump is of the ball-bearing leak-proof type.



| Line Number | CAR MAKE AND MODEL | Make | Model | Driven by | Ventilated | Field Fuse Capacity (Amps) | Thermostat Opening (° F.) | CUTOFF RELAY | | | CHARGING CONTROL | | MAXIMUM CHARGING RATE | | | | | | LIGHTS | | | Line Number | | | |
|-------------|--------------------|------|------------|-----------|------------|----------------------------|---------------------------|--------------|-----------------|-------------------|------------------|---------|-----------------------|------|-------|-----------------|------|-----------------------|----------------|------------------|-------|-------------|-------|-----------------|-------------------|
| | | | | | | | | CLOSES AT | | | Opens at (Amps) | Voltage | Current | COLD | | HOT | | Tail & Dash in Series | Headlight—Make | Tail & Stop—Make | | | | | |
| | | | | | | | | Voltage | Armature R.P.M. | Car Speed, M.P.H. | | | | Amps | Volts | Armature R.P.M. | Amps | | | | | | Volts | Armature R.P.M. | Car Speed, M.P.H. |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | American-Bantam | AL | GAR-4003-3 | B | Y | 7.5 | No | 800 | 1 1/2 | 1 1/2 | No | No | 20.0 | 20.0 | 8.0 | 2050 | 16.3 | 8.0 | 2250 | CR-BR | Race | DR | 1 | | |
| 2 | Auburn | AL | GAR-4003-3 | B | Y | 7.5 | No | 800 | 1 1/2 | 1 1/2 | No | No | 20.0 | 20.0 | 8.0 | 2050 | 16.3 | 8.0 | 2250 | CR-BR | Race | DR | 2 | | |
| 3 | Auburn | AL | GAR-4003-3 | B | Y | 7.5 | No | 800 | 1 1/2 | 1 1/2 | No | No | 20.0 | 20.0 | 8.0 | 2050 | 16.3 | 8.0 | 2250 | CR-BR | Race | DR | 3 | | |
| 4 | Auburn | AL | GAR-4003-3 | B | Y | 7.5 | No | 800 | 1 1/2 | 1 1/2 | No | No | 20.0 | 20.0 | 8.0 | 2050 | 16.3 | 8.0 | 2250 | CR-BR | Race | DR | 4 | | |
| 5 | Buick | DR | 918-S | B | Y | No | No | 800 | 8.10 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 40.8 | 8.0 | 4000 | Guide | Guide | DR | 5 | | |
| 6 | Buick | DR | 918-A | B | Y | No | No | 800 | 8.10 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 44.5 | 8.0 | 4000 | Guide | Guide | DR | 6 | | |
| 7 | Buick | DR | 918-A | B | Y | No | No | 800 | 8.10 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 44.5 | 8.0 | 4000 | Guide | Guide | DR | 7 | | |
| 8 | Buick | DR | 918-A | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 8 | | |
| 9 | Buick | DR | 918-A | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 9 | | |
| 10 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 10 | | |
| 11 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 11 | | |
| 12 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 12 | | |
| 13 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 13 | | |
| 14 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 14 | | |
| 15 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 15 | | |
| 16 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 16 | | |
| 17 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 17 | | |
| 18 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 18 | | |
| 19 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 19 | | |
| 20 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 20 | | |
| 21 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 21 | | |
| 22 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 22 | | |
| 23 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 23 | | |
| 24 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 24 | | |
| 25 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 25 | | |
| 26 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 26 | | |
| 27 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 27 | | |
| 28 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 28 | | |
| 29 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 29 | | |
| 30 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 30 | | |
| 31 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 31 | | |
| 32 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 32 | | |
| 33 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 33 | | |
| 34 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 34 | | |
| 35 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 35 | | |
| 36 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 36 | | |
| 37 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 37 | | |
| 38 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 38 | | |
| 39 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 39 | | |
| 40 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 40 | | |
| 41 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 41 | | |
| 42 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 42 | | |
| 43 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 43 | | |
| 44 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 44 | | |
| 45 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 45 | | |
| 46 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 46 | | |
| 47 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 47 | | |
| 48 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 48 | | |
| 49 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 49 | | |
| 50 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 50 | | |
| 51 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 51 | | |
| 52 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 52 | | |
| 53 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 53 | | |
| 54 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 54 | | |
| 55 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 55 | | |
| 56 | Cadillac | DR | 918-C | B | Y | No | No | 800 | 8.20 | 3 1/2 | VR | VR | 25.0 | 25.0 | 8.0 | 4000 | 51 | 8.0 | 4000 | Guide | Guide | DR | 56 | | |

CR—Current Regulator
 CR-BR—Cervan-Brown
 Dyn—Owens-Dyneto
 H—Hot
 M—Motor
 M-G—Meter Gauge and Equipment Co.
 PL—Peak Load Type
 SH—Shaft
 SK—Sparton or Klixon
 SW—Stewart-Warner
 TR—Thermostatic Relay Used
 VC—Voltage Control Unit
 VR—Voltage Regulator
 Y—Yes

How Much Advertising Sticks?

(Continued from page 862)

poor at telling what slogans are used by what automobile companies and are good at identifying only a very few. It takes money to put slogans across, but the older ones don't top the heap, although they rank well. Women are less cocksure but more accurate than men at identifying these catch-phrases. The best-identified slogans have punch

and rhythm and often include the name of the car. The best slogan is "Watch the Fords Go By."

2. Consumers are fair at tying up non-exclusive features with a few cars, and very bad at identifying them with the others. Independent springing and "V" engines are much better identified than steel tops and bodies

and hydraulic brakes. Women trail men in knowledge of these matters.

General Motors' cars are particularly well identified on these features. Surprisingly many people erroneously believe the 1936 Fords lacked steel bodies.

3. Car buyers aren't good at absorbing facts about car introductions and reintroductions. Women excel men in cognizance of feminine angles, such as Studebaker's styling by Helen Dryden.

4. The public falls down badly when it comes to knowing what cars have the exclusive features with catchy trade-names and the women know a lot less than the men about them, although comfort features secure their interest.

By no means is either much time or large advertising expense needed to put over a sufficiently striking feature, as shown by the fact that Cord's exclusive features are better known than any others in the industry. Next to Cord, the General Motors' special features show up best, with Nash and Studebaker doing well.

A few of the many features are well known, most are scarcely recognized at all. Punch rhythm, brevity, alliteration, simplicity and ease of pronunciation have helped the best-known features to sink in. Really to register, the features have to be important.

5. Men, and, to a lesser but surprising extent, women, are good at telling how many cylinders the cars have. However, some cars, notably Willys, Reo, Auburn, Hupmobile and Pierce-Arrow haven't registered the cylinder situation well.

The most heavily advertised and largely sold cars do the best on cylinder identification. The leaders are: Chevrolet, Ford and Plymouth.

6. Consumers have some strange ideas on f.o.b. price ranges, when they have any ideas at all: in the majority of cases they don't know anything about them. Women are a little better at this than men, although worse on base prices. Ford leads the field on price recognition, followed by Dodge; Willys brings up the rear.

The lower the price range, the better the consumer's knowledge.

HIGHEST AIR CLEANING EFFICIENCY



UNITED HAT TYPE OIL BATH AIR CLEANER.



UNITED OIL BATH AIR CLEANER IS DIFFERENT

PROTECTS MOTOR AT WIDEST RANGE OF THROTTLE OPENINGS.



UNEXCELLED IN REMOVING DUST AND DIRT FROM CARBURETOR AIR STREAM.



USED IN LARGE QUANTITIES BY LEADING CAR AND TRUCK MANUFACTURERS.

It contains DUAL OIL CONTROL, a feature not found in any other make of oil bath or oil wetted air cleaner. DUAL OIL CONTROL consists of application of stationary fan in filter compartment and an oil separator in oil reservoir. The fan centrifuges oil from air stream to outer wall of filter element causing quicker oil drain back and several times faster completion of oil washing cycle than in conventional type oil bath air cleaners — thus higher cleaning efficiency. Oil separator in oil reservoir provides high and low turbulence areas, oil wetting of filter element at small throttle openings without "pull over" at maximum carburetor throttle openings, quicker dirt settling, oil free of dirt for air washing at all throttle openings. This combined feature, DUAL OIL CONTROL, provides highest cleaning efficiency.

UNITED AIR CLEANER CO.

9705 COTTAGE GROVE AVE., CHICAGO, ILL.

7. Motor radio programs are rather well identified with sponsors, particularly Ford's Waring broadcast. General Motors symphony concerts don't stick in the public mind, but Ford's do. Women are nearly up to men on knowledge of automobile radio programs.
8. Car owners are good, but not entirely right in their ideas on what car companies spend most for advertising.
9. The public likes automobile advertising and finds it generally convincing—more convincing than other advertising, but women think less well of it than men.

The general picture, then, shows the consumers much in the dark about most of the matters which automobile advertising's big guns seek to drive into their consciousness. All but a few slogans and features leave them cold, and on prices they are, decidedly, at sea. Knowledge about cylinder set-ups and radio programs contribute almost the only lightening tones, if we except the occasionally good but surprising car-consciousness of women.

Perhaps consumer knowledge of advertised points isn't vital to the sale of cars. Perhaps the general impression alone does the trick fairly well. However that may be, this survey clearly shows the great weakness in public recognition of many of the key points which automobile advertising stresses and, for better or worse, turns the spotlight on the weakest and strongest of them.

Methanol As An Antifreeze

THE National Bureau of Standards does not recommend any particular material for winter use in automobile radiators but gives in its Letter Circular LC28 information regarding the advantages and disadvantages of various solutions which have been used for this purpose. Since methanol has come into much wider use as an antifreeze during the past few years, the following information may be of interest.

Methanol can be obtained from the destructive distillation of wood, or made synthetically. Methanol from wood distillation (formerly called wood alcohol) when refined to meet the specification of the Wood Chemical Institute is satisfactory for radiator use, but the crude product may contain free acids as well as ingredients which attack rubber hose. Synthetic methanol is neutral, non-corrosive, and

does not attack rubber.

Wood-distillation methanol containing 23 to 24 per cent of water is commonly marketed as "anti-freeze methanol," and this material gives about the same protection against freezing as denatured alcohol 188 deg. proof. Undiluted synthetic methanol is readily available under several trade names, and 3 quarts of this product are approximately equivalent to 4 quarts of denatured alcohol.

Although pure methanol boils at a temperature about 25 deg. F. below the boiling point of denatured alcohol, the

bureau has found that solutions of the two alcohols which give equal freezing-point protection differ only slightly as to boiling point. There is no evidence that loss of protection due to vaporization is more serious in the case of methanol than in the case of denatured alcohol.

All methanol is poisonous when taken internally, and methanol for anti-freeze use is colored with methyl violet for identification purposes. After investigating possible health hazards in connection with this use of methanol, the U. S. Bureau of Mines concluded



Examine a universal joint. If its component parts are machined all over, the joint is probably in perfect balance—and probably a "Mechanics". Castings and forgings have small irregularities which create an out-of-balance condition unless corrected. All parts in Mechanics Universal Joints having any appreciable effect on balance are machined all over thus insuring smooth running and long life. These joints are used in leading cars, trucks, busses. Investigate. Write today for complete information.

MECHANICS UNIVERSAL JOINT DIVISION
 Borg-Warner Corp. 1301 18th AVE., ROCKFORD, ILLINOIS

(Information Circular IC-6415) that "there is no danger of poisoning from the reasonable use of methanol as an anti-freeze for automobile radiators." Anti-freeze preparations containing methanol bear labels indicating the approximate percentage in accordance with the recommendations of the U. S. Public Health Service.

Most modern anti-freeze preparations contain special corrosion inhibitors. These are of two general types: soluble oils and inorganic inhibitors such as sodium borate or borax. The bureau has not investigated the pro-

portions in which these rust inhibitors are used, or their relative effectiveness.

A decree issued by the French Government on Oct. 6, regulates the qualities of fuels which can be sold under the designation of "supercarburant" or super motor fuel. These fuels must possess all of the qualities required of the "tourist" grade, from which they differ with respect to the octane number (which must be at least 75) and the composition. These fuels can be sold only under a registered trademark.

Corrosion

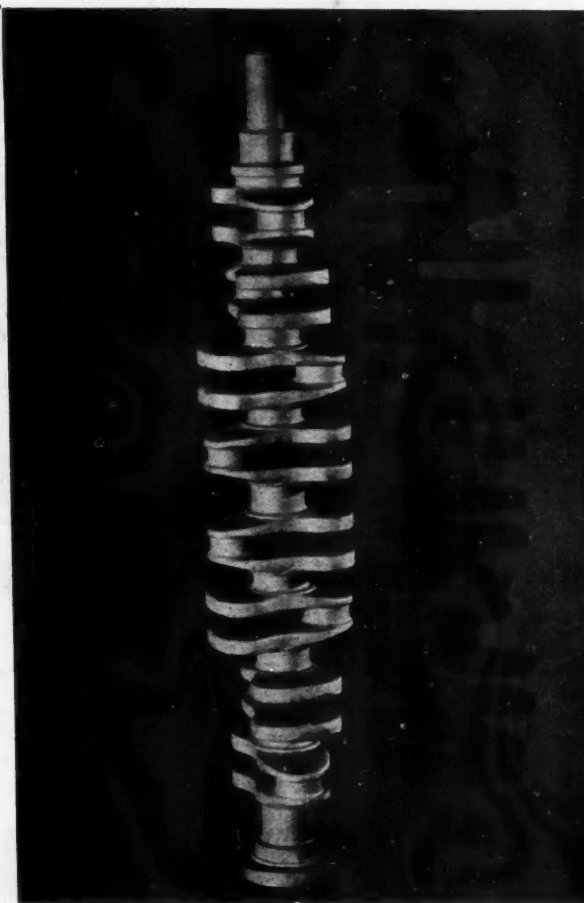
AMONG the main conclusions which can be drawn from experimental work so far carried out by a joint corrosion committee of the Iron and Steel Institute and the British Iron and Steel Federation, a report on which was submitted recently to the Iron and Steel Industrial Research Council, are that under outdoor conditions copper-bearing irons and steels corrode less than copper-free materials, the improvement being of the order of 30 per cent. In general, no marked further improvement is brought about by adding copper in excess of 0.2 per cent to 0.3 per cent to ordinary mild structural steel, although other factors probably affect this figure. The normal rolling scale produced on British wrought-irons is more resistant to weathering than that on mild steel, and affords a certain amount of protection, causing the former materials to corrode less—at least, over comparatively short periods of exposure. Insufficient data are as yet available to determine how far the modern high-tensile steels containing small amounts of copper and chromium are superior to copper steels in their resistance to atmospheric corrosion, although tests have already shown that the corrosion resistance of ordinary steels is increased by the addition of a low percentage of chromium alone. The primary coat of paint applied as a protection against atmospheric corrosion, should be of an inhibitive nature, such as red lead, and preferably be applied to a completely descaled (pickled or sand-blasted) surface, or in the shop, as soon as possible after fabrication.

Automotive Wholesale Business

(Continued from page 854)

compared with \$84,864,000 for California. The net sales for Illinois and Ohio were nearly the same, the former with \$54,584,000 against \$54,372,000 for Ohio.

The number of establishments as given by the Bureau of Census differs somewhat from the Chilton count, but these differences are in a large part due to nomenclature as to types of establishments. For instance, the Chilton company lists those large hardware houses which exist throughout the middle west and far west as automotive jobbers, because in most cases these houses have a separate and distinct automotive wholesale department. However, in the count of the Census Bureau these establishments would be listed under those of hardware merchants.



Forgings with a background—

Behind every Wyman-Gordon forging stands diligent scientific examination of every bar of steel—continuous laboratory control of all processes.

WYMAN-GORDON

Worcester, Mass.

Harvey, Ill.

Detroit, Mich.